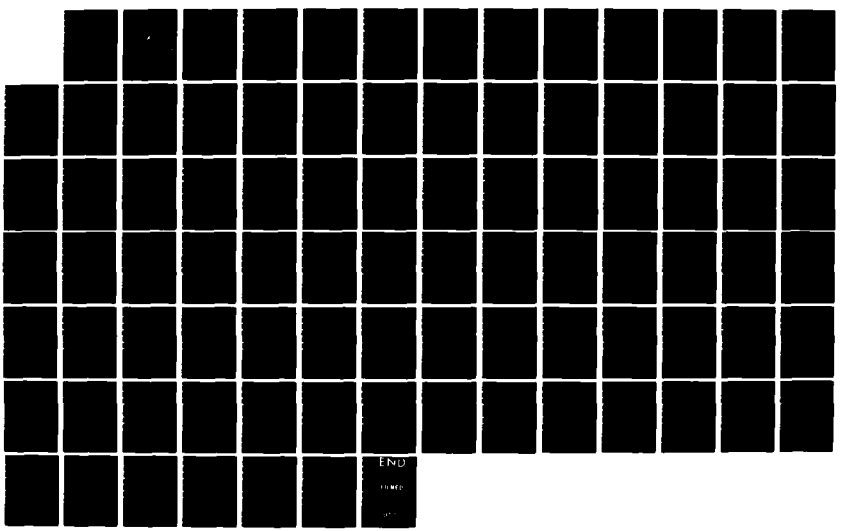
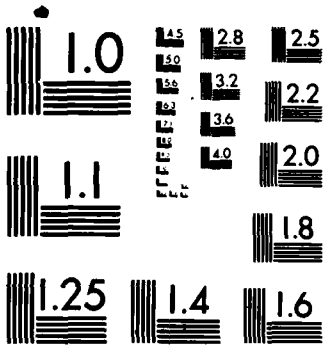
AD-A161 183 RECONSTITUTION AND RECOVERY CAPABILITY OF THE LIGHT INFANTRY COMPANY(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA H FUJIO SEP 85 1/1

UNCLASSIFIED F/G 15/7 NL





NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

RECONSTITUTION AND RECOVERY CAPABILITY
OF THE
LIGHT INFANTRY COMPANY

by

Hirome Fujio

September 1985

Thesis Advisor: Alan W. McMasters

Approved for public release; distribution is unlimited.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Reconstitution and Recovery Capability of the Light Infantry Company		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis September, 1985 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hirome Fujio		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943-5100		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943-5100		12. REPORT DATE September, 1985 13. NUMBER OF PAGES 87
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

AMORE, Reconstitution, Recoverability, Resiliency, Combat Capability, Substitutability, Mission Essential Team, Probability of Degradation, Light Infantry Company

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

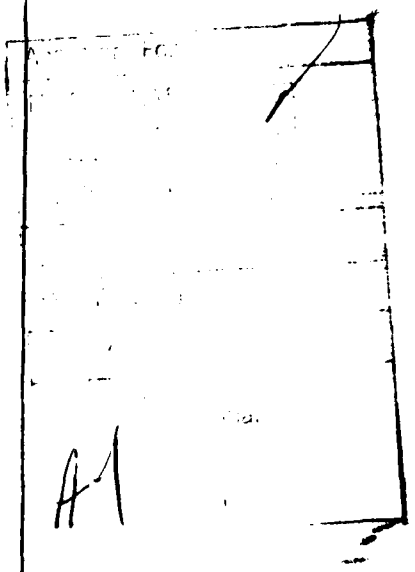
This thesis is a study of the resiliency and recoverability of the light infantry company utilizing the Analysis of Military Organizational Effectiveness (AMORE) methodology. The efficiency of the current organizational structure of the company is determined by measuring its capability against its remaining resource level after the application of degradation. A discussion of the AMORE methodology and the light infantry concept is followed by

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. the extensive input requirements of the model. A sensitivity analysis is conducted to examine the effects of changes in input parameters on the company reconstitution capabilities. The methodology is also used to determine those personnel and materiel that contributed to low rates and levels of unit recoverability. Based on the criterion established by Science Applications, Incorporated, this study concluded that the light infantry company, as it is currently designed, exhibits adequate resiliency and recoverability at degradation levels between 10 and 50 percent.



Approved for public release; distribution is unlimited.

Reconstitution and Recovery Capability of the Light Infantry Company

by

Hirome Fujio
Major, United States Army
B.B.A., University of Hawaii, 1974

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
September 1985

Author: Hirome Fujio
Hirome Fujio

Approved by: Alan W. McMasters
Alan W. McMasters, Thesis Advisor

Robert L. Keller
Robert L. Keller, Second Reader

Alan R. Washburn
Alan R. Washburn, Chairman,
Department of Operations Research

K. T. Marshall
Kneale T. Marshall,
Dean of Information and Policy Sciences

ABSTRACT

This thesis is a study of the resiliency and recoverability of the light infantry company utilizing the Analysis of Military Organizational Effectiveness (AMORE) methodology. The efficiency of the current organizational structure of the company is determined by measuring its capability against its remaining resource level after the application of degradation. A discussion of the AMORE methodology and the light infantry concept is followed by the extensive input requirements of the model. A sensitivity analysis is conducted to examine the effects of changes in input parameters on the company reconstitution capabilities. The methodology is also used to determine those personnel and materiel that contributed to low rates and levels of unit recoverability. Based on the criterion established by Science Applications, Incorporated, this study concluded that the light infantry company, as it is currently designed, exhibits adequate resiliency and recoverability at degradation levels between 10 and 50 percent.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

A. AMORE METHODOLOGY

The Analysis of Military Organizational Effectiveness (AMORE) methodology is an analytical approach for determining unit resiliency and recoverability under combat conditions. This is accomplished by analyzing the correlation between the unit's mission requirements and its capability through its available personnel and equipment resources after applying combat degradation. The unit is said to be resilient if it is able to reconstitute over the time period of a mission to a given capability level. The following factors make a unit resilient on the battlefield [Ref. 1: p. 1-4]:

1. High substitutability of personnel and materiel.
2. Minimum number of essential skills or materiel items per function.
3. Reduced probability of kill for both personnel and materiel.
4. Self-sufficient organizational elements.
5. Appropriate levels of cohesiveness.
6. Good standard operating procedures for training and implementation of reconstitution concepts.

The AMORE methodology is outlined graphically in Figure 1.1 and considers the following [Ref. 1: p. B-5]:

1. Combinations of personnel and materiel damage.
2. Degradation of personnel and materiel and their interaction as they merge together to form functional teams required for combat capability.
3. The state of training and cross-training of individual members of the organizations to include skill substitutability.

4. Substitutability and repairability of equipment.
5. The organization's ability to reconstitute its functions and regenerate combat capability as a function of time.

Initially Figure 1.1 defines the unit mission and posture, which is needed to determine the structure of essential teams. Then the functional analysis first specifies the initial strengths (assets) of personnel and materiel required by the Table of Organization and Equipment (TOE). These assets are then divided into essential teams such that each will contribute equally to mission accomplishment. Simultaneously with the functional analysis, the probabilities of degradation for personnel and materiel are determined. These are often established by the use of Joint Munitions Effectiveness Manual (JMEM) methodologies. Next the AMORE model simulates the degradation of the unit by using a Monte Carlo technique and the input probabilities. Following degradation, the unit undergoes reconstitution by using a transportation/assignment algorithm and the substitutability data. Finally the model computes the expected value of the best reconstituted unit capability for the defined mission and the simulated degradation. This forms the basis for the output analyses (Chapter III).

According to [Ref. 1: p. 1-7], Science Applications, Incorporated (SAI) has suggested that, as a minimum, a resilient unit should eventually attain a unit recovery capability which is linear with respect to damage level. This defines a reconstituted capability value of 1-PD as the resiliency threshold where PD is the probability of degradation for personnel and at least light damage for materiel. Therefore, a unit is said to be resilient if its reconstituted capability level meets or exceeds this criterion value. Figure 1.2 depicts the acceptable and unacceptable regions.

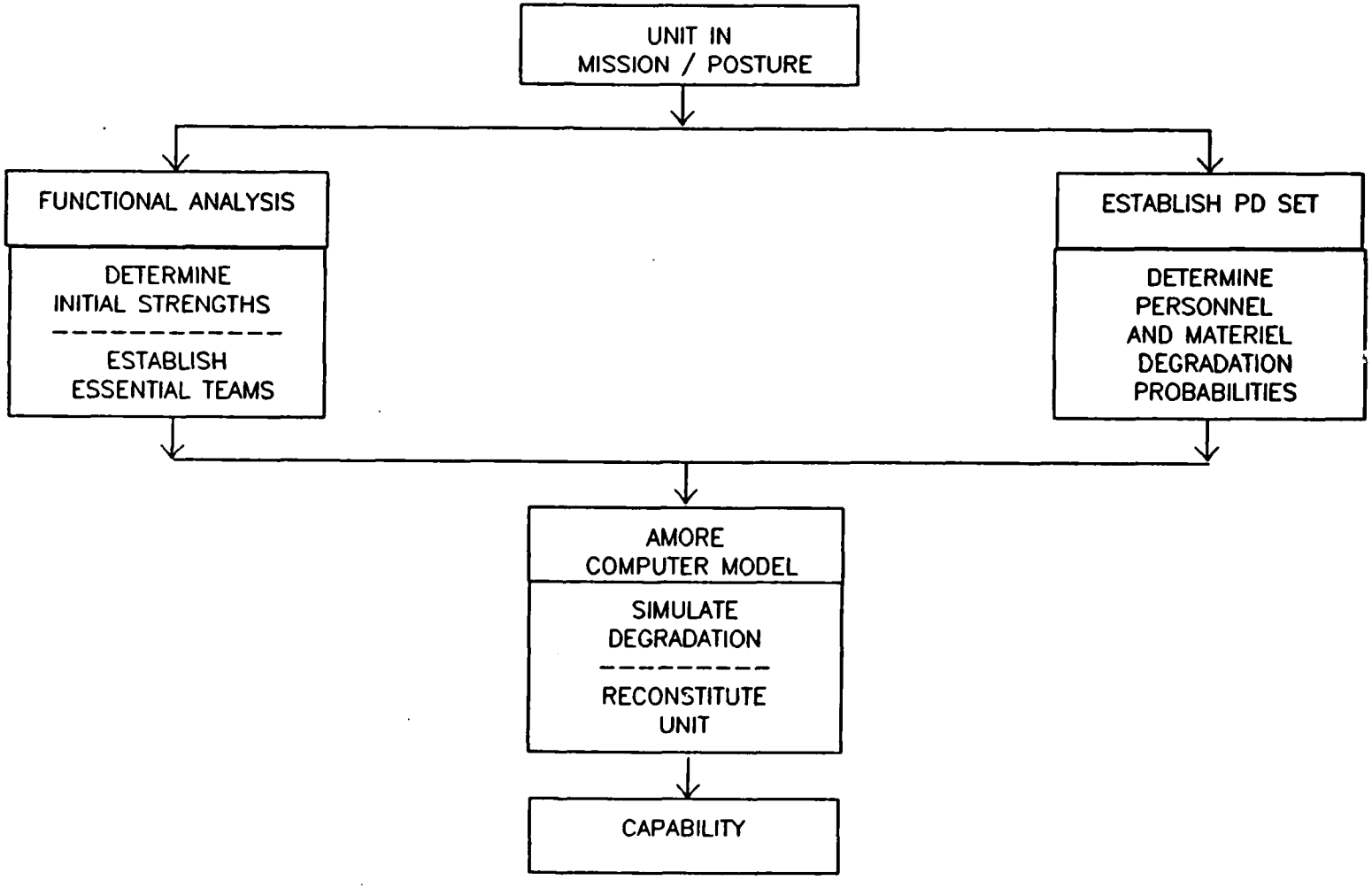


Figure 1.1 AMORE Methodology.

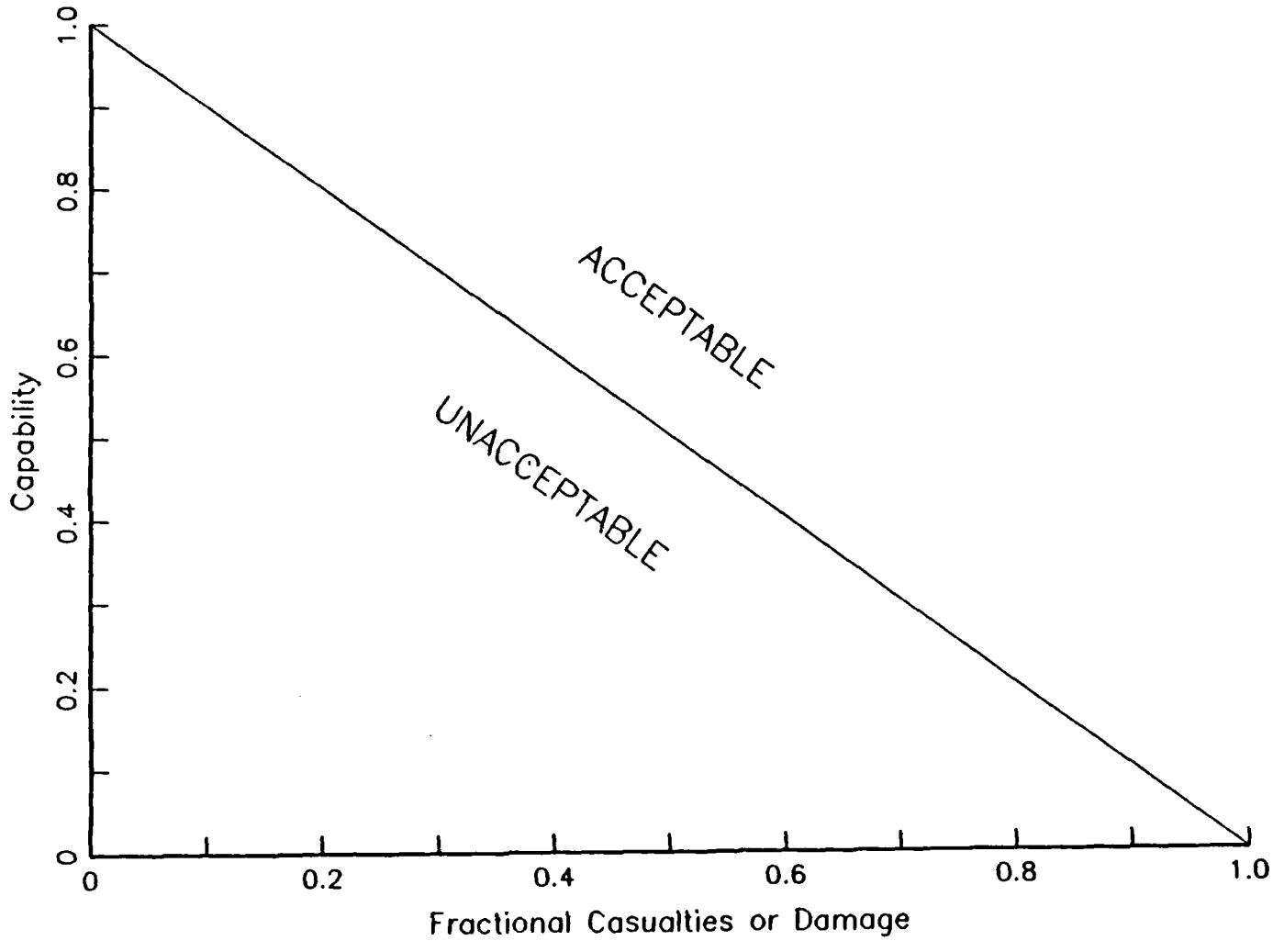


Figure 1.2 Acceptable and Unacceptable Recovery Capability Regions.

B. LIGHT INFANTRY CONCEPT

The light infantry was organized out of a necessity to have a highly-trained unit that could be deployed rapidly in response to a contingency mission anywhere in the world. The spectrum of conflict consists of the following scenarios ranging from low-intensity to high-intensity:

1. Terrorism
2. Unconventional warfare
3. Minor conventional warfare
4. Major conventional warfare
5. Theater nuclear warfare
6. Strategic nuclear warfare

The current heavy forces are designed and structured for the major conventional warfare scenario. Due to increased occurrences of crises in the low- to mid-intensity scenarios such as

1. Korea
2. Venezuela
3. Lebanon
4. Berlin
5. Cuba
6. Vietnam
7. Laos/Thailand
8. Panama
9. Dominican Republic
10. Israel
11. Grenada

it was determined that light forces were better suited to meet these kinds of crises. The light infantry is characterized by a capability to maneuver either offensively or defensively through terrain impassable by vehicles and to adapt quickly to various modes of ground, air, or water transport available to the force. It possesses a

substantial number of automatic weapons to enhance its close combat capability. Figure 1.3 [Ref. 2: p. iii] shows that a heavy infantry force such as a mechanized infantry unit in a deliberate attack on open terrain (desert, plains, valleys) generates high combat power in terms of firepower, mobility, and protection. However, this force loses considerable combat power when it is assigned missions in restrictive terrain (dry creek beds, urban or built-up areas, dense forests, mountains, jungles). The light infantry is better suited to fight in a low-intensity environment in all types of terrain and climatic conditions or in a mid- to high-intensity environment (Europe) in close terrain.

A limitation of the light infantry company is that it is completely foot-mobile, making it vulnerable to enemy artillery, mortar, and nuclear, biological, and chemical (NBC) attacks. Its survivability depends greatly on the use of cover and concealment. The light infantry soldier is the most versatile, advanced, and effective combat "system" on the battlefield and will never be duplicated in mechanical or electrical form [Ref. 3: pp. 28-29]:

1. In one package, the light infantry soldier provides an optical and aura sensor system (eyes and ears) tied into a central processor (the brain) with an incredible range of operating programs and almost infinite recoverable memory.
2. The system can be rapidly programmed (through training) and loaded through a voice-recognition system. It is, thereafter, adaptive and self-reprogrammable.
3. It can accept and apply mission-type instructions to infinitely variable terrain, conditions of visibility, size and composition of enemy force, and enemy movements and actions.

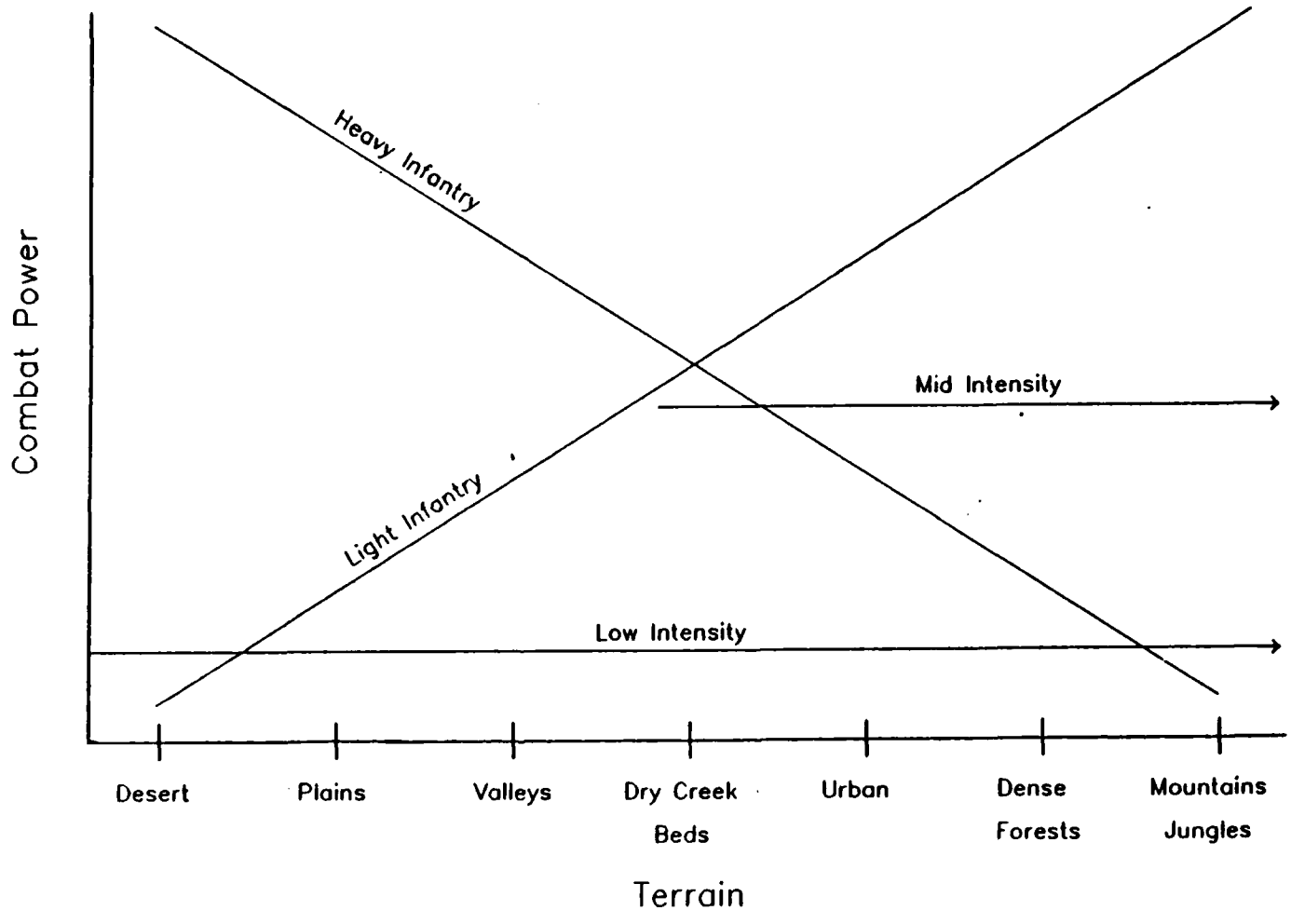


Figure 1.3 Combat Power of Heavy and Light Infantry Versus Terrain.

4. It can assess and select covered and concealed routes of advance into the enemy rear and onto his flanks.
5. All this is mounted on a multi-flex chassis capable of negotiating every kind of terrain, including water obstacles, by self-propulsion.
6. Super robotic arms, hands, and fingers with infinite degrees of freedom couple the control processor to weapons and communications devices.
7. This remarkable fighting system includes automatic and continuous position location, plus situation analysis and reporting, with a large, flexible (even entertaining) vocabulary.
8. The "system" performs target detection, identification, acquisition, munition and weapon selection, engagement, damage assessment, and reengagement as indicated by target condition.

For this unique "system", emphasis is placed on cross-training and the attainment of individual proficiency on multiple weapon systems to enhance unit flexibility. Every effort is placed on commonality in weapons and equipment to significantly reduce logistical requirements, streamline maintenance operations, and simplify repair parts management. Equipment commonality also reduces operator training requirements and facilitates cross-training. In other words, soldiers trained on one system have the basic knowledge to operate, maintain, and diagnose problems on common equipment items that are used with other systems [Ref. 4: pp. 5-6].

According to General John A. Wickham, Jr. [Ref. 5:], "The smallest Active Army in 34 years requires an Army of Excellence which optimizes combat power. If we seize this (light infantry) concept with conviction, innovativeness, and vision, the Army's land power will increase and, as a result, play a more significant role in future U.S. national security."

1. Organization of the Light Infantry Company

The light infantry company is organized as shown in Figure 1.4 [Ref. 2: p. 2]. It consists of a company headquarters platoon, composed of a headquarters section, an antiarmor (AA) section, and a mortar section, and three rifle platoons, each composed of a headquarters section and three rifle squads. A rifle squad operates in two fire teams, each consisting of four men. The company has no organic vehicles but it can use the support platoon's motorcycles if necessary.

The medium antiarmor weapons (Dragon) are consolidated at company level to preclude encumbering the rifle platoons with a bulky weapon system that may impede their rate of movement in a low-intensity environment where armor targets are scarce. This also enables the company commander to provide rapid response based on the situation. The antiarmor section can be used as an additional rifle unit if the company is not faced with an enemy armor threat. The M-60 machineguns (two per platoon) are placed, controlled, and displaced by the platoon leader.

With the availability of night vision goggles and night vision sights, the light infantry company is capable of conducting operations under all visibility conditions.

2. Missions of the Light Infantry Company

a. Offense

The primary purpose of offensive operations is to destroy the capability of the enemy and/or his will to fight. This is accomplished by:

1. Attacking the enemy from the least expected area.
2. Concentrating effort in one direction while forcing the enemy to fight in two or more directions.

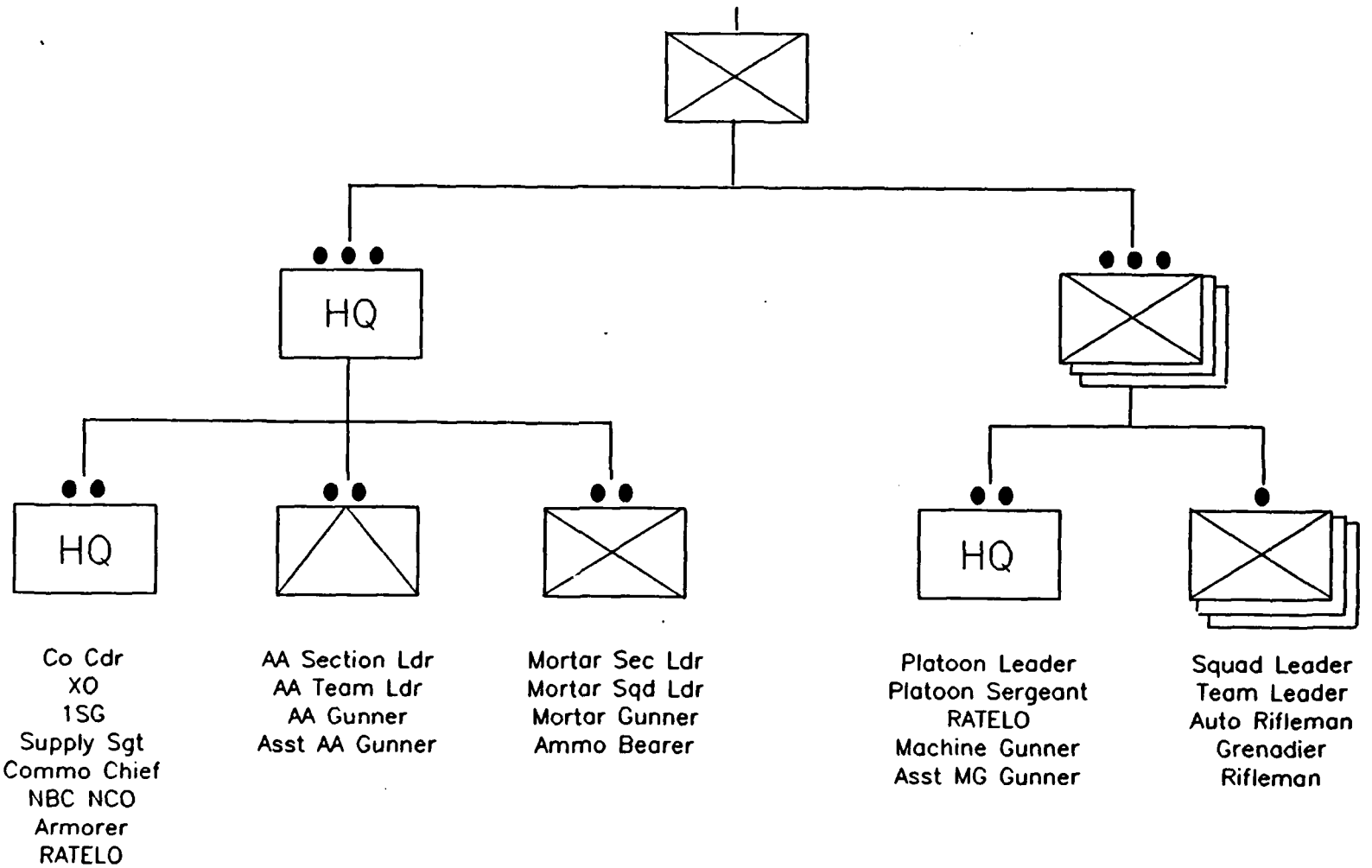


Figure 1.4 Organization of the Light Infantry Company.

3. Destroying or wearing down enemy troops.
4. Penetrating the enemy's defenses to attack key combat service, combat service support, and command, control, and communications elements.
5. Seizing key terrain to enable maximum capability on favorable ground.

The light infantry company can achieve maximum success by employing sound principles of fire and movement and attacking in restrictive terrain such as towns, swamps, forests, and mountains. It can also maximize surprise by attacking the flanks and rear of the enemy at night or during limited visibility.

The light infantry company is capable of conducting the following offensive operations [Ref. 4: pp. B-9 - B-12]:

1. Movement to contact
2. Hasty attack
3. Deliberate attack
4. Pursuit and exploitation when opposed by light enemy forces

Movement to contact - conducted to locate the enemy, develop the situation, and maintain the initiative. Decentralized control, rapid execution, and responsive fire support are critical to defeating the enemy.

Hasty attack - conducted to defeat an ill-prepared enemy force quickly or to take advantage of an enemy weakness. The effective use of indirect and supporting weapon systems, suppression of enemy fire support and air defense, and efficient application of combat support assets increase the devastating effect of the swift, violent maneuver against an ill-prepared enemy.

Deliberate attack - conducted to defeat a strong enemy force in well-prepared positions that cannot be overcome by a hasty attack. The main effort is directed toward the enemy's weakest point.

Exploitation and pursuit - conducted to cut off enemy dismounted infantry forces and defeat remaining forces, conduct military operations on urban terrain (MOUT), and destroy pockets of resistance.

b. Defense

The light infantry company is capable of defending against enemy light forces. However, as was depicted in Figure 1.3, it can also defend against tank and motorized units in close terrain. Defensive operations are conducted in order to:

1. Cause an enemy attack to fail by destroying him or forcing him to withdraw.
2. Control essential terrain or secure a key area to deny enemy entry.
3. Gain time to prepare for a subsequent offense.
4. Economize forces in one area to allow concentration elsewhere.
5. Reduce the enemy capability for offensive action.

The light infantry company is capable of conducting the following defensive operations:

1. Defend in sector
2. Defend from a battle position
3. Defend a strongpoint

Defend in sector - This is the most frequent defensive mission. The company defends in an area characterized by positions in depth and coordination with adjacent units. Defending in depth entails drawing the enemy into the sector and conducting multiple and repeated surprise attacks throughout the depths of its formation.

Defend from a battle position - This mission is assigned when key terrain must be held or when the position is located in a favorable engagement area. It is characterized by obstacles to slow the enemy and stop it in the

engagement area such that the battle position can engage targets from the flanks and rear.

Defend a strongpoint - This mission prevents the enemy from bypassing or reducing the strongpoint without expending excessive amounts of resources and time. A strongpoint is usually located in restrictive terrain such as thick forests, mountains, swamps, urban areas, etc., that cannot be easily bypassed.

C. PURPOSE AND SCOPE

Because of the importance of the light infantry concept to the United States Army, this thesis investigated the composition and mechanics of a light infantry company to identify, from a set of alternatives, the force structure that maximizes unit resiliency on the battlefield for a night defensive mission in a nuclear, biological, and chemical (NBC) environment. The AMORE methodology was used to evaluate the alternatives.

Although the United States Army Infantry School (USAIS) conducted an AMORE analysis of the light infantry company as input to the AMORE Analysis of the Light Infantry Division prepared by Science Applications, Incorporated, it was constrained by time and resident experience on the AMORE model, resulting in an analysis that was not performed at the level of detail and depth as this study. Additionally, the USAIS analysis considered the organization of the light infantry company before a mortar section was included in the TOE. This thesis analyzed the company subsequent to that change.

D. PREVIEW

Chapter II discusses the input information that must be determined before the AMORE methodology can be exercised.

The development of these input data required an extensive analysis of the unit and its mission in conjunction with subject matter experts. Chapter III provides the output analyses based on the transformation of the input information into measures of organizational capability. The analyses focus on the recovery potential of the unit and include developing capability as a function of time and identifying critical resources. A sensitivity analysis is conducted in Chapter IV. It examines the effects of changes in degradation probabilities and the definition of a mission essential team on unit reconstitution capabilities. Chapter V summarizes the analyses, and presents conclusions and recommendations based on the results of these analyses.

II. INPUT DATA

A. GENERAL

The AMORE methodology requires a significant amount of input data based on an evaluation of a unit's capabilities, organizational and operational concepts, and resources provided in the Table of Organization and Equipment. The following data elements are required to run the base case using the AMORE methodology:

1. Unit mission.
2. TOE or starting strength of personnel and materiel.
3. Personnel and materiel transfer matrices.
4. Repair time for materiel.
5. Probability of degradation for personnel and materiel.
6. Commander's decision time.
7. Essential team requirements for personnel and materiel.
8. Number of simulation iterations.

B. UNIT MISSION

Although the unit mission is not input directly, it determines the requirements for essential teams. For this analysis, the light infantry company is in a six-hour night defensive posture in a nuclear, biological, and chemical (NBC) environment. This presents a stressful situation which requires most of the skill groups and equipment types, thereby providing the most information about the company performing its combat function.

C. INITIAL STRENGTH

The initial strength pertains to the number of personnel by grade and military occupational specialty (MOS) and the number of significant items of equipment specified in the TOE. These listings are depicted in Table I and Table II. Although the fire support team chief, the fire support team sergeant, the fire support team radio telephone operator (RATELO), the medic, the forward observer, and the forward observer RATELO are not included in the TOE, they are usually attached to the light infantry company during operations and are therefore included in Table I.

D. TRANSFER MATRIX

A transfer matrix identifies the personnel and materiel that are substitutable for other personnel and materiel and the amount of time it takes to complete the substitution. The matrix consists of row and column headings corresponding to the row or line numbers of the personnel or materiel. An entry indicates the time, in minutes, it takes for a row skill or materiel item to substitute for a column skill or materiel item. Zero entries indicate that substitutions take place immediately while dots denote substitutions that would not normally occur or would be infeasible. The diagonal entries represent the intersections of the rows and columns with equal numbers. The transfer times used for this analysis were developed from discussions with subject matter experts from the Light Division Certification Board of the US Army Combat Developments Experimentation Center (CDEC) at Fort Ord.

1. Personnel

The transfer matrix for personnel displays the substitutability of one personnel for another in terms of

TABLE I

LISTING OF PERSONNEL INITIAL STRENGTHS

	Personnel Skill Groups	Grade	MOS	Qty
	Company Headquarters:			
1	Company Commander	O-3	11B00	1
2	Executive Officer	O-2	11B00	1
3	First Sergeant	E-8	11B5M	1
4	Supply Sergeant	E-6	76Y30	1
5	Communications Chief	E-6	31V30	1
6	NBC NCO	E-5	54E20	1
7	Armorer	E-4	76Y10	1
8	Company RATELO	E-3	11B10	2
9	Fire Support Team Chief	O-2	13A00	1
10	Fire Support Team Sergeant	E-6	13F30	1
11	Fire Support Team RATELO	E-4	13F10	1
	Antiarmor Section:			
12	Antiarmor Section Leader	E-6	11B30	1
13	Antiarmor Team leader	E-5	11B20	3
14	Antiarmor Gunner	E-4	11B10	6
15	Asst Antiarmor Gunner	E-3	11B10	3
	Mortar Section:			
16	Mortar Section Leader	E-6	11C30	1
17	Mortar Squad Leader	E-5	11C20	1
18	Mortar Gunner	E-4	11C10	2
19	Ammunition Bearer	E-3	11C10	2
	Platoon Headquarters:			
20	Platoon Leader	O-2	11B00	3
21	Platoon Sergeant	E-7	11B4G	3
22	Platoon RATELO	E-3	11B10	3
23	Machinegun Gunner	E-4	11B10	6
24	Asst Machinegun Gunner	E-3	11B10	6
25	Medic	E-4	91A10	3
26	Forward Observer	E-5	13F20	3
27	Forward Observer RATELO	E-3	13F10	3
	Rifle Squad:			
28	Squad Leader	E-6	11B30	9
29	Team Leader	E-5	11B20	18
30	Automatic Rifleman	E-4	11B10	18
31	Grenadier	E-4	11B10	18
32	Rifleman	E-3	11B10	18
			Total	142

TABLE II

LISTING OF MATERIEL INITIAL STRENGTHS

	Materiel	Quantity
1	Binocular	13
2	Chemical Alarm	1
3	Compass, Magnetic	2
4	Dragon	6
5	Grenade Launcher 40mm M-203	18
6	Infrared Viewer AN/PAS-7	4
7	Machinegun 7.62mm M-60	6
8	Mortar 60mm	2
9	Night Vision Goggles AN/PVS-5	36
10	Night Vision Sight AN/PVS-4	18
11	Night Vision Sight AN/TVS-5	6
12	Pistol Caliber .45	7
13	Platoon Early Warning System	3
14	Radiac Detector Charger	1
15	Radiac Set AN/PDR-27	1
16	Radiacmeter IM-174/PD	3
17	Radiacmeter IM-185/UD	12
18	Radio Set AN/PRC-77	6
19	Rifle 5.56mm M-16A2	84
20	Small Unit Transceiver	12
21	Speech Security Equipment	4
22	Squad Automatic Weapon	18
23	Tape Reader	1
24	Telephone Set TA-1/PT	14
25	Telephone Set TA-312/PT	1

the average time required to reach an acceptable operational capability. Table III presents the 32 x 32 matrix of personnel transfer times, in minutes, for the light infantry company. It can be seen that there is significant potential for substitution between infantry MOS codes (11xxx; see Table I) but only limited potential for headquarters elements and attached personnel (fire support team, forward observer teams, and medics).

Personnel skill substitutions during reorganization and reconstitution following degradation were limited to those substitutions that would normally occur instead of considering every possibility. For example, although the company commander has the skill and training to substitute for a rifleman, he would not assume that role.

Transfer times ranged from 1 to 45 minutes (with the exception of diagonal elements). For the most part, the increased transfer times resulted from substitutions involving greater differences in proficiency levels and from the distance that had to be travelled during limited visibility between positions of one personnel to the other. In the case of the light infantry company in the defense mission, that distance could be as much as 750 meters, depending on the terrain. The time penalty assessed for travel varied from 5 to 15 minutes.

2. Materiel

A similar matrix for materiel substitution times is presented in Table IV. Due to the nature and organization of the light infantry company, the unit possesses relatively few essential materiel items. This provides very little potential for these items to substitute for one another. The most significant elements of materiel transfer times are adjustment and repositioning times.

E. MATERIEL REPAIR TIME

The times to repair light (operator level or first echelon maintenance) and moderate (organizational level or second echelon maintenance) materiel damage are shown in Table V. According to [Ref. 6: p. 6], doctrine dictates 18 minutes as the time limit for light repair and four hours as the time limit for moderate repair. Any equipment exceeding four hours of repair time is assumed to be not repairable by the organizational level and therefore is considered lost to the unit.

TABLE III

TRANSFER MATRIX FOR PERSONNEL

	Personnel	1	2	3	4	5	6	7	8	9	10
1	Company Commander	0	2	2	.	.	.	.	.	10	10
2	Executive Officer	10	0	2	.	.	.	.	.	10	10
3	First Sergeant	20	10	0	20	.	.	.	.	.	10
4	Supply Sergeant	.	.	20	0	.	.	5	5	.	.
5	Communications Chief	.	.	20	15	0	.	10	5	.	.
6	NBC NCO	.	.	20	15	.	0	10	5	.	.
7	Armorer	.	.	.	15	.	.	0	10	.	.
8	Company RATELO	.	.	.	.	.	.	.	0	.	.
9	Fire Support Team Chief	10	.	5	.	.	.	.	.	0	1
10	Fire Support Team Sergeant	.	.	45	.	.	.	.	.	3	0
11	Fire Support Team RATELO	.	.	.	.	.	.	.	10	10	15
12	Antiarmor Section Leader	.	.	40	.	.	.	.	.	.	.
13	Antiarmor Team leader	.	.	.	.	.	.	.	.	.	.
14	Antiarmor Gunner	.	.	.	.	.	.	.	.	.	.
15	Asst Antiarmor Gunner	.	.	.	.	.	.	.	.	.	.
16	Mortar Section Leader	.	.	45	.	.	.	.	.	.	.
17	Mortar Squad Leader	.	.	.	.	.	.	.	.	.	.
18	Mortar Gunner	.	.	.	.	.	.	.	.	.	.
19	Ammunition Bearer	.	.	.	.	.	.	.	.	.	.
20	Platoon Leader	20	15	20	.	.	.	.	.	20	20
21	Platoon Sergeant	45	35	30	.	.	.	.	.	25	25
22	Platoon RATELO	.	.	.	.	.	.	.	20	.	.
23	Machinegun Gunner	.	.	.	.	.	.	.	.	.	.
24	Asst Machinegun Gunner	.	.	.	.	.	.	.	.	.	.
25	Medic	.	.	.	.	.	.	.	.	.	.
26	Forward Observer	.	.	.	.	.	.	.	.	.	25
27	Forward Observer RATELO	.	.	.	.	.	.	.	20	.	35
28	Squad Leader	.	.	40	.	.	.	.	.	.	.
29	Team Leader	.	.	.	.	.	.	.	.	.	.
30	Automatic Rifleman	.	.	.	.	.	.	.	.	.	.
31	Grenadier	.	.	.	.	.	.	.	.	.	.
32	Rifleman	.	.	.	.	.	.	.	.	.	.

Table III

TRANSFER MATRIX FOR PERSONNEL (CONT'D.)

	Personnel	11	12	13	14	15	16	17	18	19	20	21
1	Company Commander	.	10	.	.	.	.	.	.	.	10	10
2	Executive Officer	.	10	.	.	.	.	.	.	.	10	10
3	First Sergeant	.	10	.	.	.	.	.	.	.	15	15
4	Supply Sergeant	.	.	.	.	.	.	.	.	.	.	.
5	Communications Chief	10	.	.	.	.	.	.	.	.	.	.
6	NBC NCO	.	.	.	.	.	.	.	.	.	.	.
7	Armorer	.	.	.	15	.	.	.	.	15	.	.
8	Company RATELO	15	.	.	20	15	.	.	.	15	.	.
9	FIST Chief	1	.	.	.	.	.	.	.	.	25	20
10	FIST Sergeant	1	.	.	.	.	.	.	.	.	.	30
11	FIST RATELO	0	.	.	.	.	.	.	.	.	.	.
12	Antiarmor Section Ldr	.	0	5	5	5	.	.	.	.	.	15
13	Antiarmor Team leader	.	15	0	5	5	.	.	.	.	.	30
14	Antiarmor Gunner	.	25	15	0	1	.	.	.	.	.	.
15	Asst Antiarmor Gunner	.	.	25	1	0	.	.	.	.	.	.
16	Mortar Section Leader	.	.	.	.	.	0	2	2	2	.	30
17	Mortar Squad Leader	.	.	.	.	.	5	0	2	2	.	25
18	Mortar Gunner	.	.	.	.	.	15	10	0	2	.	.
19	Ammunition Bearer	.	.	.	.	.	.	.	2	0	.	.
20	Platoon Leader	.	5	5	5	.	25	20	15	.	0	2
21	Platoon Sergeant	.	5	5	5	.	30	25	20	.	10	0
22	Platoon RATELO	25	.	25	15	5	.	.	.	.	.	.
23	Machinegun Gunner	.	25	15	10	5	.	.	.	.	.	.
24	Asst Machinegun Gunner	.	.	25	10	5	.	.	.	.	.	.
25	Medic	.	.	.	.	.	.	.	.	.	.	.
26	Forward Observer	10	.	.	.	.	.	.	.	.	.	.
27	Forward Observer RATELO	10	.	.	.	.	.	.	.	.	.	.
28	Squad Leader	.	15	10	5	.	35	30	25	.	.	15
29	Team Leader	.	25	20	5	5	40	35	30	.	.	30
30	Automatic Rifleman	.	35	25	10	5	.	.	.	30	.	.
31	Grenadier	.	35	25	10	5	.	.	.	30	.	.
32	Rifleman	.	.	30	10	5	.	.	.	35	.	.

Table III

TRANSFER MATRIX FOR PERSONNEL (CONT'D.)

	Personnel	22	23	24	25	26	27	28	29	30	31	32
1	Company Commander	.	.	.	.	.	.	.	.	.	.	.
2	Executive Officer	.	.	.	.	.	.	.	.	.	.	.
3	First Sergeant	.			.	.	.	.	.			
4	Supply Sergeant	.	15	10	.	.	.	.	.	15	15	10
5	Communications Chief	.	15	10	.	.	.	.	.	15	15	10
6	NBC NCO	.	15	10	.	.	.	.	.	15	15	10
7	Armorer		15	10	.	.	.	.	.	15	15	10
8	Company RATELO	10	15	10	.	.	15	.	.	15	15	10
9	FIST Chief	.	.	.	.	10	10	.	.	.	.	10
10	FIST Sergeant	.	.	.	.	10	10	.	.	.	.	10
11	FIST RATELO	15	.	.	.	20	10	.	.	.	.	10
12	Antiarmor Section Ldr	5	5	5	.	.	.	10	5	5	5	5
13	Antiarmor Team leader	5	5	5	.	.	.	20	15	5	5	5
14	Antiarmor Gunner	10	5	5	.	.	.	30	20	5	5	5
15	Asst Antiarmor Gunner	10	5	5	.	.	.		25	5	5	5
16	Mortar Section Leader	.	15	10	.	.	.	25	20	15	15	10
17	Mortar Squad Leader	.	15	10	.	.	.	30	25	15	15	10
18	Mortar Gunner	.	15	10	.	.	.	35	30	15	15	10
19	Ammunition Bearer	.	15	10	.	.	.	.	.	15	15	10
20	Platoon Leader	2	5	.	.	.	.	5	5	5	5	5
21	Platoon Sergeant	2	5	.	.	.	.	5	5	5	5	5
22	Platoon RATELO	0	15	10	.	.	.	.	20	15	15	5
23	Machinegun Gunner	10	0	1	.	.	.	30	20	5	5	5
24	Asst Machinegun Gunner	10	1	0	.	.	.	.	25	5	5	5
25	Medic	.	.	.	0	.	.	.	.	.	.	.
26	Forward Observer	10	.	.	.	0	2	.	.	.	.	10
27	Forward Observer RATELO	10	.	.	.	10	0	.	.	.	.	10
28	Squad Leader	5	5	.	.	.	.	0	5	5	5	5
29	Team Leader	5	5	5	.	.	.	15	0	5	5	5
30	Automatic Rifleman	10	5	5	.	.	.	25	15	0	5	5
31	Grenadier	10	5	5	.	.	.	25	15	5	0	5
32	Rifleman	10	5	5	.	.	.	.	25	5	5	0

TABLE IV

TRANSFER MATRIX FOR MATERIEL

	Materiel	1	2	3	4	5	6	7	8	9
1	Binocular	0	.	.	.	.	.	.	.	.
2	Chemical Alarm	.	0	.	.	.	.	.	.	.
3	Compass, Magnetic	.	.	0	.	.	.	.	.	.
4	Dragon	.	.	.	0	.	.	.	.	.
5	Grenade Launcher 40mm M-203	.	.	.	.	0	.	45	40	.
6	Infrared Viewer AN/PAS-7	5	.	.	.	.	0	.	.	5
7	Machinegun 7.62mm M-60	.	.	.	.	20	.	0	.	.
8	Mortar 60mm	.	.	.	.	.	.	.	0	.
9	Night Vision Goggles AN/PVS-5	.	.	.	.	.	.	.	.	0
10	Night Vision Sight AN/PVS-4	.	.	.	.	.	.	.	.	5
11	Night Vision Sight AN/TVS-5	.	.	.	.	.	30	.	.	5
12	Pistol Caliber .45	.	.	.	.	.	.	.	.	.
13	Platoon Early Warning System	.	.	.	.	.	.	.	.	.
14	Radiac Detector Charger	.	.	.	.	.	.	.	.	.
15	Radiac Set AN/PDR -27	.	.	.	.	.	.	.	.	.
16	Radiacmeter IM-174/PD	.	.	.	.	.	.	.	.	.
17	Radiacmeter IM-185/UD	.	.	.	.	.	.	.	.	.
18	Radio Set AN/PRC-77	.	.	.	.	.	.	.	.	.
19	Rifle 5.56mm M-16A2	.	.	.	.	25	.	45	.	.
20	Small Unit Transceiver	.	.	.	.	.	.	.	.	.
21	Speech Security Equipment	.	.	.	.	.	.	.	.	.
22	Squad Automatic Weapon	.	.	.	.	10	.	5	.	.
23	Tape Reader	.	.	.	.	.	.	.	.	.
24	Telephone Set TA-1/PT	.	.	.	.	.	.	.	.	.
25	Telephone Set TA-312/PT	.	.	.	.	.	.	.	.	.

Table IV

TRANSFER MATRIX FOR MATERIEL (CONT'D.)

	Materiel	10	11	12	13	14	15	16	17
1	Binocular	.	.	.	30	.	.	.	.
2	Chemical Alarm	.	.	.	.	.	.	.	.
3	Compass, Magnetic	.	.	.	.	.	.	.	.
4	Dragon	.	.	.	.	.	.	.	.
5	Grenade Launcher 40mm M-203	.	.	5	.	.	.	.	.
6	Infrared Viewer AN/PAS-7	10	10	.	30	.	.	.	.
7	Machinegun 7.62mm M-60	.	.	5	.	.	.	.	.
8	Mortar 60mm	.	.	.	.	.	.	.	.
9	Night Vision Goggles AN/PVS-5	10	10	.	30	.	.	.	.
10	Night Vision Sight AN/PVS-4	0	10	.	30	.	.	.	.
11	Night Vision Sight AN/TVS-5	10	0	.	30	.	.	.	.
12	Pistol Caliber .45	.	.	0	.	.	.	.	.
13	Platoon Early Warning System	.	.	.	0	.	.	.	.
14	Radiac Detector Charger	.	.	.	.	0	.	.	.
15	Radiac Set AN/PDR -27	.	.	.	.	.	0	5	5
16	Radiacmeter IM-174/PD	.	.	.	.	.	30	0	.
17	Radiacmeter IM-185/UD	.	.	.	.	.	.	.	0
18	Radio Set AN/PRC-77	.	.	.	.	.	.	.	.
19	Rifle 5.56mm M-16A2	.	.	5	.	.	.	.	.
20	Small Unit Transceiver	.	.	.	.	.	.	.	.
21	Speech Security Equipment	.	.	.	.	.	.	.	.
22	Squad Automatic Weapon	.	.	5	.	.	.	.	.
23	Tape Reader	.	.	.	.	.	.	.	.
24	Telephone Set TA-1/PT	.	.	.	.	.	.	.	.
25	Telephone Set TA-312/PT	.	.	.	.	.	.	.	.

Table IV

TRANSFER MATRIX FOR MATERIEL (CONT'D.)

	Materiel	18	19	20	21	22	23	24	25
1	Binocular	.	.	.	.	.	.	.	.
2	Chemical Alarm	.	.	.	.	.	.	.	.
3	Compass, Magnetic	.	.	.	.	.	.	.	.
4	Dragon	.	.	.	.	.	.	.	.
5	Grenade Launcher 40mm M-203	.	1	.	.	5	.	.	.
6	Infrared Viewer AN/PAS-7	.	.	.	.	.	.	.	.
7	Machinegun 7.62mm M-60	.	5	.	.	1	.	.	.
8	Mortar 60mm	.	.	.	.	.	.	.	.
9	Night Vision Goggles AN/PVS-5	.	.	.	.	.	.	.	.
10	Night Vision Sight AN/PVS-4	.	.	.	.	.	.	.	.
11	Night Vision Sight AN/TVS-5	.	.	.	.	.	.	.	.
12	Pistol Caliber .45	.	.	.	.	.	.	.	.
13	Platoon Early Warning System	.	.	.	.	.	.	.	.
14	Radiac Detector Charger	.	.	.	.	.	.	.	.
15	Radiac Set AN/PDR -27	.	.	.	.	.	.	.	.
16	Radiacmeter IM-174/PD	.	.	.	.	.	.	.	.
17	Radiacmeter IM-185/UD	.	.	.	.	.	.	.	.
18	Radio Set AN/PRC-77	0	.	5	.	.	.	.	.
19	Rifle 5.56mm M-16A2	.	0	.	.	30	.	.	.
20	Small Unit Transceiver	30	.	0	.	.	.	.	.
21	Speech Security Equipment	.	.	.	0	.	.	.	.
22	Squad Automatic Weapon	.	2	.	.	0	.	.	.
23	Tape Reader	.	.	.	.	.	0	.	.
24	Telephone Set TA-1/PT	.	.	.	.	.	.	0	30
25	Telephone Set TA-312/PT	.	.	.	.	.	.	30	0

TABLE V

MATERIEL REPAIR TIME

	Materiel	Repair Time (Minutes) Light Damage	Moderate Damage
1	Binocular	18	240
2	Chemical Alarm	18	240
3	Compass, Magnetic	18	240
4	Dragon	18	240
5	Grenade Launcher 40mm M-203	18	240
6	Infrared Viewer AN/PAS-7	18	240
7	Machinegun 7.62mm M-60	18	240
8	Mortar 60mm	18	240
9	Night Vision Goggles AN/PVS-5	18	240
10	Night Vision Sight AN/PVS-4	18	240
11	Night Vision Sight AN/TVS-5	18	240
12	Pistol Caliber .45	18	240
13	Platoon Early Warning System	18	240
14	Radiac Detector Charger	18	240
15	Radiac Set AN/PDR-27	18	240
16	Radiacmeter IM-174/PD	18	240
17	Radiacmeter IM-185/UD	18	240
18	Radio Set AN/PRC-77	18	240
19	Rifle 5.56mm M-16A2	18	240
20	Small Unit Transceiver	18	240
21	Speech Security Equipment	18	240
22	Squad Automatic Weapon	18	240
23	Tape Reader	18	240
24	Telephone Set TA-1/PT	18	240
25	Telephone Set TA-312/PT	18	240

F. PROBABILITY OF DEGRADATION SET

A probability of degradation set (PD set) consists of both the degradation probabilities and the commander's decision times for personnel and materiel. This set is presented in Tables VI and VII. The degradation probabilities for personnel and materiel are determined by the unit posture and the threat being simulated.

1. Personnel PD

Personnel probabilities of degradation can be derived from the Joint Munitions Effectiveness Manual based on the light infantry company in a defensive posture against conventional weapon systems. The recommended degradation probability is 0.10 by the Combined Arms Center (CAC) at Fort Leavenworth.

2. Materiel PD

Materiel probabilities of degradation are required for light and moderate damage (repairable in the unit) and for severe damage (lost to the unit). The Combined Arms Center recommended that the corresponding degradation probabilities should be 0.10, 0.05, and 0.02. In Table VII, the cumulative "at least light" column is the sum of the individual light, moderate, and severe PD's, the "at least moderate" column is the sum of the moderate and severe PD's, and the "severe" column is only the severe PD. These cumulative PD's are required by the AMORE model.

3. Commander's Decision Time

In any given situation following degradation, a commander needs time to assess the condition of the unit and decide how to reorganize. This decision time is in addition to any transfer times (personnel and materiel) except for diagonal elements. It takes into consideration the time lost due to the initial impact following an attack, which may result in a brief period of confusion, demoralization, and immediate aid to casualties. After the initial reaction period, the commander's decision time will involve time elements for damage assessment, communication of damage and casualty reports, the commander's evaluation and decision process, and communication of decisions for employment of

surviving assets to reconstitute the unit [Ref. 7: page 20]. A time of five minutes, concurred by subject matter experts at the Light Division Certification Board at CDEC, for all levels of degradation was used for this analysis.

TABLE VI

PROBABILITY OF PERSONNEL DEGRADATION SET

	Personnel	Commander's Decision Time (min)	Degradation Probability
1	Company Commander	5	0.10
2	Executive Officer	5	0.10
3	First Sergeant	5	0.10
4	Supply Sergeant	5	0.10
5	Communications Chief	5	0.10
6	NBC NCO	5	0.10
7	Armorer	5	0.10
8	Company RATELO	5	0.10
9	Fire Support Team Chief	5	0.10
10	Fire Support Team Sergeant	5	0.10
11	Fire Support Team RATELO	5	0.10
12	Antiarmor Section Leader	5	0.10
13	Antiarmor Team leader	5	0.10
14	Antiarmor Gunner	5	0.10
15	Asst Antiarmor Gunner	5	0.10
16	Mortar Section Leader	5	0.10
17	Mortar Squad Leader	5	0.10
18	Mortar Gunner	5	0.10
19	Ammunition Bearer	5	0.10
20	Platoon Leader	5	0.10
21	Platoon Sergeant	5	0.10
22	Platoon RATELO	5	0.10
23	Machinegun Gunner	5	0.10
24	Asst Machinegun Gunner	5	0.10
25	Medic	5	0.10
26	Forward Observer	5	0.10
27	Forward Observer RATELO	5	0.10
28	Squad Leader	5	0.10
29	Team Leader	5	0.10
30	Automatic Rifleman	5	0.10
31	Grenadier	5	0.10
32	Rifleman	5	0.10

TABLE VII

PROBABILITY OF MATERIEL DEGRADATION SET

	Materiel	Commander's Decision Time (min)	Damage Probabilities: Noncumulative Lt	Noncumulative Mod	Noncumulative Sev	Cumulative: At Least Lt	At Least Mod	At Least Sev
1	Binocular	5	.05	.03	.02	.10	.05	.02
2	Chemical Alarm	5	.05	.03	.02	.10	.05	.02
3	Compass, Magnetic	5	.05	.03	.02	.10	.05	.02
4	Dragon	5	.05	.03	.02	.10	.05	.02
5	Grenade Launcher 40mm M-203	5	.05	.03	.02	.10	.05	.02
6	Infrared Viewer AN/PAS-7	5	.05	.03	.02	.10	.05	.02
7	Machinegun 7.62mm M-60	5	.05	.03	.02	.10	.05	.02
8	Mortar 60mm	5	.05	.03	.02	.10	.05	.02
9	Night Vision Goggles AN/PVS-5	5	.05	.03	.02	.10	.05	.02
10	Night Vision Sight AN/PVS-4	5	.05	.03	.02	.10	.05	.02
11	Night Vision Sight AN/TVS-5	5	.05	.03	.02	.10	.05	.02
12	Pistol Caliber .45	5	.05	.03	.02	.10	.05	.02
13	Platoon Early Warning System	5	.05	.03	.02	.10	.05	.02
14	Radiac Detector Charger	5	.05	.03	.02	.10	.05	.02
15	Radiac Set AN/PDR-27	5	.05	.03	.02	.10	.05	.02
16	Radiacmeter IM-174/PD	5	.05	.03	.02	.10	.05	.02
17	Radiacmeter IM-185/UD	5	.05	.03	.02	.10	.05	.02
18	Radio Set AN/PRC-77	5	.05	.03	.02	.10	.05	.02
19	Rifle 5.56mm M-16A2	5	.05	.03	.02	.10	.05	.02
20	Small Unit Transceiver	5	.05	.03	.02	.10	.05	.02
21	Speech Security Equipment	5	.05	.03	.02	.10	.05	.02
22	Squad Automatic Weapon	5	.05	.03	.02	.10	.05	.02
23	Tape Reader	5	.05	.03	.02	.10	.05	.02
24	Telephone Set TA-1/PT	5	.05	.03	.02	.10	.05	.02
25	Telephone Set TA-312/PT	5	.05	.03	.02	.10	.05	.02

G. MISSION ESSENTIAL TEAM (MET)

The AMORE capability analysis requires the breakdown of the unit into essential teams, consisting of only those personnel and materiel elements which are necessary to accomplish a mission. In the case of the light infantry company, the smallest combat force is the fire team consisting of the following elements: team leader, automatic rifleman, grenadier, and rifleman. If an element is missing for any given essential team, that team then has no mission capability [Ref. 8: p. 2-10]. Using the fire team as the basic increment of capability, eighteen teams were constructed to produce the increment of mission performance. An effort was made to distribute basic skills and equipment as evenly as possible across the various increments of capability.

1. Personnel

Table VIII shows the personnel mission essential teams for the light infantry company. It can be noted that the teams contain a command element along with a full complement of infantry, antiarmor, and mortar personnel required for night defensive operations. The executive officer, supply sergeant, armorer, fire support team, medics, and the forward observer teams were not considered essential to this particular mission.

2. Materiel

The composition of the materiel mission essential teams of the light infantry company is presented in Table IX. These elements represent the equipment associated with the proper personnel. Only major items of equipment are listed and each item is considered to include all of its component parts. Some items which are issued on the basis

of one per individual (protective masks, bayonets) are not included.

H. NUMBER OF ITERATIONS

An iteration includes application of damage to personnel and materiel, assessment of surviving resources, reconstitution of the maximum number of mission essential teams, and evaluation of an expected value of unit capability at specified time periods. The number of iterations must be greater than or equal to two for proper program execution. According to the User's Manual [Ref. 9: p. 2-32], fifty iterations are generally sufficient to provide statistically significant convergence of results. Thus, fifty iterations were used in the analysis of the light infantry company.

TABLE VIII

MISSION ESSENTIAL TEAMS - PERSONNEL

	Personnel	MET 1	MET 2	MET 3	MET 4	MET 5	MET 6	MET 7	MET 8	MET 9
1	Company Commander	0	0	0	0	0	0	1	0	0
2	Executive Officer	0	0	0	0	0	0	0	0	0
3	First Sergeant	0	0	0	0	0	0	0	0	0
4	Supply Sergeant	0	0	0	0	0	0	0	0	0
5	Communications Chief	0	0	0	0	0	0	0	0	0
6	NBC NCO	0	0	0	0	0	0	0	0	0
7	Armorer	0	0	0	0	0	0	0	0	0
8	Company RATELO	0	0	0	0	0	0	1	0	0
9	Fire Support Team Chief	0	0	0	0	0	0	0	0	0
10	Fire Support Team Sergeant	0	0	0	0	0	0	0	0	0
11	Fire Support Team RATELO	0	0	0	0	0	0	0	0	0
12	Antiarmor Section Leader	0	0	0	0	0	0	0	0	1
13	Antiarmor Team leader	0	0	1	0	0	0	0	0	1
14	Antiarmor Gunner	0	0	1	0	1	0	0	0	1
15	Asst Antiarmor Gunner	0	0	0	0	1	0	0	0	0
16	Mortar Section Leader	0	0	0	0	0	0	0	0	0
17	Mortar Squad Leader	0	0	0	0	0	0	1	0	0
18	Mortar Gunner	0	0	0	0	0	0	1	0	0
19	Ammunition Bearer	0	0	0	0	0	0	1	0	0
20	Platoon Leader	0	0	1	0	0	0	1	0	0
21	Platoon Sergeant	0	0	0	1	0	0	0	0	0
22	Platoon RATELO	0	0	1	0	0	0	1	0	0
23	Machinegun Gunner	0	1	0	1	0	0	0	1	0
24	Asst Machinegun Gunner	0	1	0	1	0	0	0	1	0
25	Medic	0	0	0	0	0	0	0	0	0
26	Forward Observer	0	0	0	0	0	0	0	0	0
27	Forward Observer RATELO	0	0	0	0	0	0	0	0	0
28	Squad Leader	0	1	0	1	0	1	0	1	0
29	Team Leader	1	1	1	1	1	1	1	1	1
30	Automatic Rifleman	1	1	1	1	1	1	1	1	1
31	Grenadier	1	1	1	1	1	1	1	1	1
32	Rifleman	1	1	1	1	1	1	1	1	1

Table VIII

MISSION ESSENTIAL TEAMS - PERSONNEL (CONT'D)

	Personnel	MET 10	MET 11	MET 12	MET 13	MET 14	MET 15	MET 16	MET 17	MET 18
1	Company Commander	0	0	0	0	0	0	0	0	0
2	Executive Officer	0	0	0	0	0	0	0	0	0
3	First Sergeant	0	0	1	0	0	0	0	0	0
4	Supply Sergeant	0	0	0	0	0	0	0	0	0
5	Communications Chief	0	0	0	0	0	0	0	0	1
6	NBC NCO	0	0	0	0	0	0	0	0	1
7	Armorer	0	0	0	0	0	0	0	0	0
8	Company RATELO	0	0	0	0	0	0	0	0	0
9	Fire Support Team Chief	0	0	0	0	0	0	0	0	0
10	Fire Support Team Sergeant	0	0	0	0	0	0	0	0	0
11	Fire Support Team RATELO	0	0	0	0	0	0	0	0	0
12	Antiarmor Section Leader	0	0	0	0	0	0	0	0	0
13	Antiarmor Team leader	0	0	0	0	0	1	0	0	0
14	Antiarmor Gunner	0	1	0	0	0	1	0	1	0
15	Asst Antiarmor Gunner	0	1	0	0	0	0	0	1	0
16	Mortar Section Leader	0	0	0	1	0	0	0	0	0
17	Mortar Squad Leader	0	0	0	0	0	0	0	0	0
18	Mortar Gunner	0	0	0	1	0	0	0	0	0
19	Ammunition Bearer	0	0	0	1	0	0	0	0	0
20	Platoon Leader	0	0	0	1	0	0	0	0	0
21	Platoon Sergeant	0	0	0	0	0	0	1	0	0
22	Platoon RATELO	0	0	0	1	0	0	0	0	0
23	Machinegun Gunner	1	0	0	0	1	0	1	0	0
24	Asst Machinegun Gunner	1	0	0	0	1	0	1	0	0
25	Medic	0	0	0	0	0	0	0	0	0
26	Forward Observer	0	0	0	0	0	0	0	0	0
27	Forward Observer RATELO	0	0	0	0	0	0	0	0	0
28	Squad Leader	1	0	1	0	1	0	1	0	1
29	Team Leader	1	1	1	1	1	1	1	1	1
30	Automatic Rifleman	1	1	1	1	1	1	1	1	1
31	Grenadier	1	1	1	1	1	1	1	1	1
32	Rifleman	1	1	1	1	1	1	1	1	1

TABLE IX

MISSION ESSENTIAL TEAMS - MATERIEL

	Materiel	MET 1	MET 2	MET 3	MET 4	MET 5	MET 6	MET 7	MET 8	MET 9
1	Binocular	0	1	1	1	0	1	2	1	0
2	Chemical Alarm	0	0	0	0	0	0	0	0	0
3	Compass, Magnetic	0	0	0	0	0	0	1	0	0
4	Dragon	0	0	1	0	1	0	0	0	1
5	Grenade Launcher 40mm M-203	1	1	1	1	1	1	1	1	1
6	Infrared Viewer AN/PAS-7	0	0	1	0	0	0	1	0	1
7	Machinegun 7.62mm M-60	0	1	0	1	0	0	0	1	0
8	Mortar 60mm	0	0	0	0	0	0	0	1	0
9	Night Vision Goggles AN/PVS-5	2	2	2	2	2	2	2	2	2
10	Night Vision Sight AN/PVS-4	1	1	1	1	1	1	1	1	1
11	Night Vision Sight AN/TVS-5	0	1	0	1	0	0	0	1	0
12	Pistol Caliber .45	0	1	0	1	0	0	1	1	0
13	Platoon Early Warning System	0	0	1	0	0	0	1	0	0
14	Radiac Detector Charger	0	0	0	0	0	0	0	0	0
15	Radiac Set AN/PDR-27	0	0	0	0	0	0	0	0	0
16	Radiacmeter IM-174/PD	0	0	1	0	0	0	1	0	0
17	Radiacmeter IM-185/UD	0	1	1	1	0	1	1	1	0
18	Radio Set AN/PRC-77	0	0	1	0	0	0	2	0	1
19	Rifle 5.56mm M-16A2	2	4	6	5	4	3	9	4	5
20	Small Unit Transceiver	0	1	1	1	0	1	0	1	1
21	Speech Security Equipment	0	0	0	0	0	0	0	0	0
22	Squad Automatic Weapon	1	1	1	1	1	1	1	1	1
23	Tape Reader	0	0	0	0	0	0	0	0	0
24	Telephone Set TA-1/PT	0	1	1	1	0	1	2	1	0
25	Telephone Set TA-312/PT	0	0	0	0	0	0	0	0	0

Table IX

MISSION ESSENTIAL TEAMS - MATERIEL (CONT'D)

	Materiel	MET 10	MET 11	MET 12	MET 13	MET 14	MET 15	MET 16	MET 17	MET 18
1	Binocular	1	0	1	1	1	0	1	0	1
2	Chemical Alarm	0	0	0	0	0	0	0	0	1
3	Compass, Magnetic	0	0	0	1	0	0	0	0	0
4	Dragon	0	1	0	0	0	1	0	1	0
5	Grenade Launcher 40mm M-203	1	1	1	1	1	1	1	1	1
6	Infrared Viewer AN/PAS-7	0	0	0	1	0	0	0	0	0
7	Machinegun 7.62mm M-60	1	0	0	0	1	0	1	0	0
8	Mortar 60mm	0	0	0	1	0	0	0	0	0
9	Night Vision Goggles AN/PVS-5	2	2	2	2	2	2	2	2	2
10	Night Vision Sight AN/PVS-4	1	1	1	1	1	1	1	1	1
11	Night Vision Sight AN/TVS-5	1	0	0	0	1	0	1	0	0
12	Pistol Caliber .45	1	0	0	0	1	0	1	0	0
13	Platoon Early Warning System	0	0	0	1	0	0	0	0	0
14	Radiac Detector Charger	0	0	0	0	0	0	0	0	1
15	Radiac Set AN/PDR-27	0	0	0	0	0	0	0	0	1
16	Radiacmeter IM-174/PD	0	0	0	1	0	0	0	0	0
17	Radiacmeter IM-185/UD	1	0	1	1	1	0	1	0	1
18	Radio Set AN/PRC-77	0	0	0	2	0	0	0	0	0
19	Rifle 5.56mm M-16A2	5	4	4	7	4	4	5	4	5
20	Small Unit Transceiver	1	0	1	0	1	1	1	0	1
21	Speech Security Equipment	0	0	0	0	0	0	0	0	0
22	Squad Automatic Weapon	1	1	1	1	1	1	1	1	1
23	Tape Reader	0	0	0	0	0	0	0	0	0
24	Telephone Set TA-1/PT	1	0	1	2	1	0	1	0	1
25	Telephone Set TA-312/PT	0	0	0	0	0	0	0	0	1

III. ANALYSES OF UNIT CAPABILITY

A. GENERAL

This chapter looks at those personnel and materiel factors which influence the light infantry company's ability to reconstitute its combat capability following an attack. Some of the factors which affect its recoverability are [Ref. 1: p. 5-1]:

1. The number of personnel and materiel items which are authorized by the TOE and the number that survive after an attack.
2. The transferability of personnel and materiel to other skills or functions.
3. The time required to accomplish the transfer (including delay and repair times).
4. The demand of the essential teams for specific types and numbers of personnel and materiel items.

The AMORE methodology considers the above factors in producing the output for the base case from the available data.

The following assumptions apply in the analyses:

1. Personnel and materiel systems for the base case light infantry company are from the TOE developed by the US Army Training and Doctrine Command (TRADOC).
2. The light infantry company is at 100% strength (as defined by the TOE) at the beginning of the mission.
3. Personnel are fully trained and qualified in their Military Occupational Specialty (MOS).
4. Materiel systems are operationally combat ready at the beginning of the mission.

5. Available weapon systems have an adequate supply of ammunition for the entire mission.
6. Stress, fatigue, morale, etc. are not explicitly considered.

The two most important outputs used as the basis for the analyses of this chapter are:

1. Unit capability - the average recovery capability the total unit (both personnel and materiel) has attained by a given time.
2. Available surpluses and shortages - those elements (either personnel or materiel) that prevented the unit from having additional capability (shortages) and those which are not being utilized (surpluses).

B. UNIT CAPABILITY

1. Mean Fraction of Capability

The rate of reconstitution is a function of the times required for transfer and/or repair of assets. The AMORE methodology allows the user to use average times or random exponential simulated times based on the input mean or expected times. The exponential distribution is known as a frequently observed waiting time distribution. For this analysis, the "mean time only" option was considered sufficient for determining capability.

Table X presents the mean fraction of pre-degradation capability for personnel and materiel as a function of time after degradation. These capabilities are evaluated at the specified time periods, and at minimum and infinite times. The minimum time capability is evaluated immediately after the start of the reconstitution. All transfers are in progress, but only those with a total time (transfer + commander's decision + equipment repair) of zero have been completed. Infinite time or maximum capability is

evaluated when all possible transfers and all possible equipment repairs have been made. The "Unit" column gives the unit capability which is the minimum of the personnel and materiel capabilities derived from the average for all iterations [Ref. 9: p. 2-50]. Additionally, the confidence limit based on the t-test of significance for a 90 percent confidence level (two-sided) is given for each of the mean capabilities. The basic equation is [Ref. 10: p. 3-84]:

$$90\%\ CI = \pm t_n \sqrt{\frac{\sum X_i^2 - (\sum X_i)^2 / N}{N(N-1)}} \qquad \text{(eqn 3.1)}$$

where X_i = capability for iteration i;

N = number of simulation iterations ($2 < N < \infty$);

t_n = table value of t for N-1 degrees of freedom.

An example of how to read the table is as follows: after 0.5 hours, personnel regained a mean capability of 96.2 percent, materiel reached 69.9 percent, and the minimum or unit mean capability was 69.9 percent. Maximum recovery is accomplished between 4.0 and 4.25 hours. This can be identified by the first point in time where the value of unit capability reaches its maximum. The 90 percent confidence interval for the unit capability can be calculated using eqn. 3.1 at that time and the range is from 0.913 to 0.933.

Figure 3.1 depicts the graphical representation of the mean data presented in Table X. It does not indicate any significant divergence between the personnel and materiel capability over time. It does show that materiel is always the limiting or minimum factor at any time after 0.25 hours. At 0.25 hours the materiel capability and unit capability become and continue to be equal. Prior to that

TABLE X

UNIT CAPABILITY OVER TIME
(BASE CASE)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.394	0.033	0.589	0.034	0.376	0.027
0.250	0.747	0.043	0.618	0.032	0.596	0.035
0.500	0.962	0.011	0.699	0.035	0.699	0.035
0.750	0.974	0.007	0.797	0.025	0.797	0.025
1.000	0.974	0.007	0.798	0.025	0.798	0.025
1.250	0.974	0.007	0.798	0.025	0.798	0.025
1.500	0.974	0.007	0.798	0.025	0.798	0.025
1.750	0.974	0.007	0.798	0.025	0.798	0.025
2.000	0.974	0.007	0.798	0.025	0.798	0.025
2.250	0.974	0.007	0.798	0.025	0.798	0.025
2.500	0.974	0.007	0.798	0.025	0.798	0.025
2.750	0.974	0.007	0.798	0.025	0.798	0.025
3.000	0.974	0.007	0.798	0.025	0.798	0.025
3.250	0.974	0.007	0.798	0.025	0.798	0.025
3.500	0.974	0.007	0.798	0.025	0.798	0.025
3.750	0.974	0.007	0.798	0.025	0.798	0.025
4.000	0.974	0.007	0.798	0.025	0.798	0.025
4.250	0.974	0.007	0.923	0.010	0.923	0.010
4.500	0.974	0.007	0.923	0.010	0.923	0.010
4.750	0.974	0.007	0.923	0.010	0.923	0.010
5.000	0.974	0.007	0.923	0.010	0.923	0.010
5.250	0.974	0.007	0.923	0.010	0.923	0.010
5.500	0.974	0.007	0.923	0.010	0.923	0.010
5.750	0.974	0.007	0.923	0.010	0.923	0.010
6.000	0.974	0.007	0.923	0.010	0.923	0.010
Infinity	0.974	0.007	0.923	0.010	0.923	0.010

time, the personnel capability was lower than the materiel capability.

Based on the resiliency threshold (1-PD) discussed in Chapter I, it can be seen that the light infantry company is resilient at a 10 percent degradation level (degradation probability, PD, of 10 percent for personnel and 10 percent at least light damage for materiel). The maximum capabilities are 97.4 percent and 92.3 percent for personnel and materiel, respectively. The value of Figure 3.1 to the Army is that it portrays the light infantry company as being self-sufficient and effective on the battlefield at a light level of degradation.

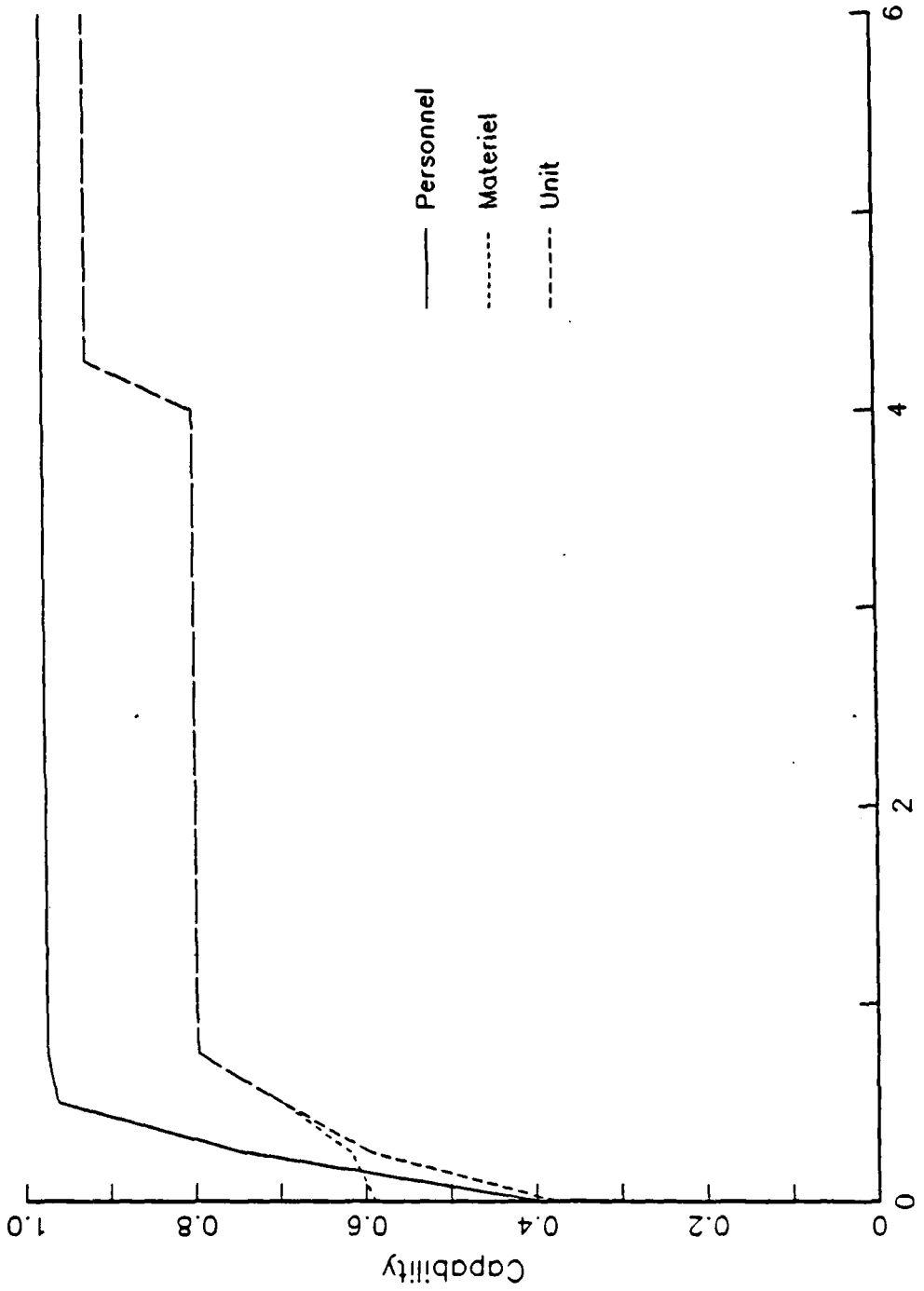


Figure 3.1 Resilience Curve (Base Case).

2. Integral of Unit Capability with Respect to Time

Table XI provides the output of the cumulative area under the capability curve. This area provides a measure of the accumulated effective unit hours over the six-hour time period.

TABLE XI

INTEGRAL OF UNIT CAPABILITY OVER TIME
(BASE CASE)

Time (Hours)	Unit Capability	Unit Hours	Team Hours
Minimum	0.376	0.000	0.000
0.250	0.596	0.121	2.185
0.500	0.699	0.283	5.097
0.750	0.797	0.470	8.462
1.000	0.798	0.669	12.050
1.250	0.798	0.869	15.640
1.500	0.798	1.068	19.230
1.750	0.798	1.268	22.820
2.000	0.798	1.467	26.410
2.250	0.798	1.667	30.000
2.500	0.798	1.866	33.590
2.750	0.798	2.066	37.180
3.000	0.798	2.265	40.770
3.250	0.798	2.464	44.360
3.500	0.798	2.664	47.950
3.750	0.798	2.863	51.540
4.000	0.798	3.063	55.130
4.250	0.923	3.278	59.002
4.500	0.923	3.509	63.157
4.750	0.923	3.740	67.157
5.000	0.923	3.970	71.467
5.250	0.923	4.201	75.622
5.500	0.923	4.432	79.777
5.750	0.923	4.663	83.932
6.000	0.923	4.894	88.087

The unit capability (Unit column from Table X), as mentioned earlier, is the minimum of the personnel and materiel capabilities derived from the average for all iterations. The unit hours available to the light infantry company define the maximum potential output of the company in time. This means that a full-up unit at 100 percent capability would have one unit hour available in one hour. Unit output is expressed in terms of team hours where one team hour is defined as the amount of work one team can do in one hour. The maximum value for the light infantry company would be 18 team hours of output work every hour. The average cumulative area is given in terms of the unit hours and team hours that are available from the beginning of reorganization to the desired time. Table XI shows that 0.669 unit hours were available in the first hour or 12.050 team hours from an eighteen-team unit. The light infantry company has recovered to 79.8 percent capability at the end of the first hour. However, the potential work the company could have produced in that hour is only 66.9 percent of a full-up unit. Figure 3.2 graphically shows the effective unit hours compared to a reference line representing a unit at 100 percent capability over the entire time.

C. CHOKE ANALYSIS

The choke analysis output (Appendix A) provides the information on why the light infantry company was unable to reconstitute to full capability by infinite time. The output includes those items needed (Needs), on the average, to complete the designated team and those items excess (Surplus), on the average, to the requirements of that team. The standard deviation for these averages is also given.

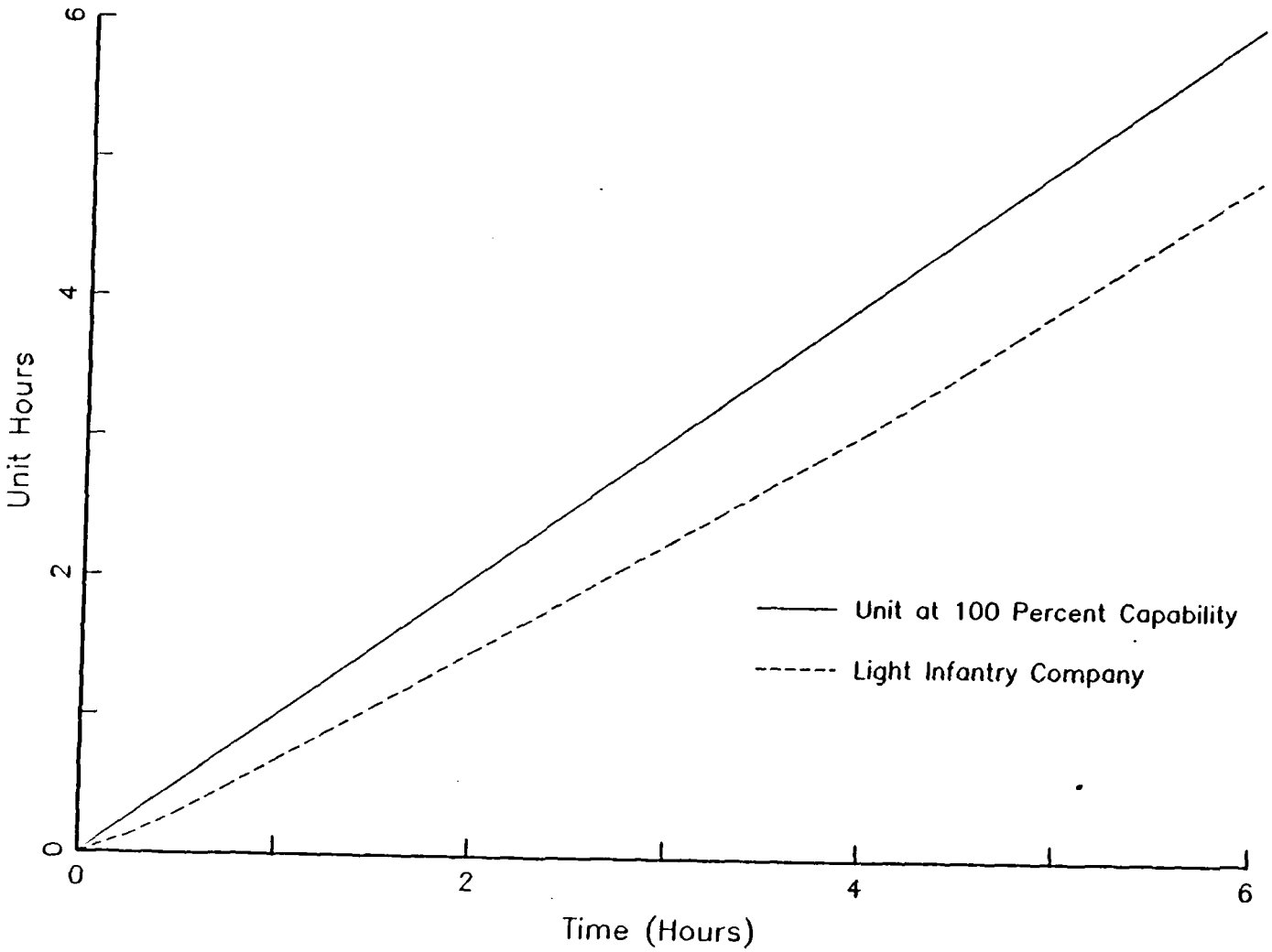


Figure 3.2 Effective Unit Hours (Base Case).

Those personnel and materiel items critical to additional capability in the unit are identified as need items while the surplus items show where possible changes in transfer capability could be used to increase unit recovered capability. The number of teams attempted (one beyond the optimal solution team) is provided along with the number of iterations for which this "next" team was attempted [Ref. 9: p. 2-53].

1. Personnel Requirements and Shortages

As expected, the richness of total personnel due to substitutability is apparent in the light infantry company as evidenced by Tables XXI and XXII in Appendix A. For example, in the results listed in Table XXI labelled "(Team 18)", seventeen teams were built and the eighteenth team was attempted to be built. The model failed to complete the eighteenth team twenty-three times out of the fifty iterations (The other twenty-seven attempts will be shown on additional printouts at the appropriate team level of attempted completion). The attempted construction of the eighteenth team failed (choked) due to the personnel needs in column one by the amounts specified by the values as listed. These values were derived by the following expression:

$$\left(\sum_{i=1}^{n} (\text{total number of shortages by skill})_i\right)/n$$

where n = number of failures (iterations).

The major items contributing to the choke on the eighteenth team were as follows:

1. Communication Chief (skill number 5)
2. Antiarmor Gunner (skill number 14)
3. Mortar Gunner (skill number 18)
4. Squad Leader (skill number 28)
5. Team Leader (skill number 29)
6. Automatic Rifleman (skill number 30)
7. Grenadier (skill number 31)

Table XXII is denoted by "After Last Team" and indicates that the "next" team increment solution is not required since all eighteen teams can be built. Therefore, the average needs are not necessary, resulting in only a listing of average surplus and standard deviation of surplus. The fifty iterations of the simulation are accounted for as follows: seventeen teams were built in the twenty-three iterations of Table XXI, and eighteen teams were built in the twenty-seven iterations (23 + 27 = 50) of Table XXII.

2. Materiel Requirements and Shortages

Tables XXIII through XXVI in Appendix A display the choke analysis output for materiel. An examination of Table XXIV shows that the sixteenth team was attempted five times, resulting in a maximum capability of fifteen teams. This was caused by a lack of materiel items 18 and 20. On the average, team sixteen required 0.80 of item 18, an AN/PRC-77 radio set, and 0.20 of item 20, a small unit transceiver. In other words, in four of the five iterations an AN/PRC-77 radio set was needed to build the sixteenth team while the remaining iteration required a small unit transceiver. Analyzing the remainder of the choke data for materiel in a similar method results in a Dragon (item number 4) being needed to build the fifteenth team in one iteration, a

binocular (item number 1) being needed to build the seventeenth team in one of the six iterations, and a Dragon being needed in the other five iterations. Thirty-eight iterations choked on team eighteen in Table XXVI due to a lack of most of the materiel items. To account for all fifty iterations of the materiel run, the following summary of results is provided:

Number of Teams Built	Number of Iterations
14	1
15	5
16	6
17	38
	50

D. CONCLUSIONS

Based on the results from the analyses of the two outputs, the following observations are made:

1. The recovery capability of the light infantry company at the end of its assigned mission indicates that it is resilient at the 10 percent level of degradation.
2. Resiliency is limited by some items of equipment, particularly the Dragon which is a low-density equipment. Improving survivability for the Dragon would increase reconstitution capability.
3. Although all eighteen personnel essential teams were built in 54 percent of the iterations, improved capability could be accomplished by increasing the substitutability for squad leaders and team leaders.

IV. SENSITIVITY ANALYSIS

A. GENERAL

This chapter investigates how sensitive the AMORE simulation output measure of effectiveness of the light infantry company is to changes in the input parameters. A review of existing AMORE literature indicates that the model provides sensitivity analyses to changes in practically every input factor. This analysis examined the sensitivity to changes in the following input parameters, which are considered by the author to be of primary importance to the light infantry company analysis:

1. Probability of degradation
2. Mission essential teams

These will be referred to as Alternative Cases I and II.

B. PROBABILITY OF DEGRADATION

1. Small Variations in Personnel PD

The base case in Chapter III assumed a 10 percent probability of degradation for all personnel in the light infantry company. This section will allow the degradation probabilities to vary with the relative location of each of the personnel in the defensive position. It should be expected that vulnerability levels would vary depending on the degree of exposure. Table XII illustrates such a possible situation. As an example, squad members (PD = 0.12) are more exposed to direct fire weapons than those personnel in the company headquarters position (PD = 0.08). These probability of degradation values were developed from discussions with subject matter experts at the Light

Division Certification Board at CDEC. It was determined that values between 0.06 and 0.14 would be considered reasonable to classify as a light level of damage.

TABLE XII

PROBABILITY OF PERSONNEL DEGRADATION SET
(ALTERNATIVE CASE I)

	Personnel	Commander's Decision Time (min)	Degradation Probability
1	Company Commander	5	0.12
2	Executive Officer	5	0.08
3	First Sergeant	5	0.08
4	Supply Sergeant	5	0.08
5	Communications Chief	5	0.08
6	NBC NCO	5	0.08
7	Armorer	5	0.08
8	Company RATELO	5	0.08
9	Fire Support Team Chief	5	0.08
10	Fire Support Team Sergeant	5	0.08
11	Fire Support Team RATELO	5	0.08
12	Antiarmor Section Leader	5	0.12
13	Antiarmor Team leader	5	0.12
14	Antiarmor Gunner	5	0.12
15	Asst Antiarmor Gunner	5	0.12
16	Mortar Section Leader	5	0.08
17	Mortar Squad Leader	5	0.08
18	Mortar Gunner	5	0.08
19	Ammunition Bearer	5	0.08
20	Platoon Leader	5	0.12
21	Platoon Sergeant	5	0.12
22	Platoon RATELO	5	0.10
23	Machinegun Gunner	5	0.12
24	Asst Machinegun Gunner	5	0.12
25	Medic	5	0.10
26	Forward Observer	5	0.10
27	Forward Observer RATELO	5	0.10
28	Squad Leader	5	0.12
29	Team Leader	5	0.12
30	Automatic Rifleman	5	0.12
31	Grenadier	5	0.12
32	Rifleman	5	0.12

The AMORE model was then run with all other input parameters kept constant. Table XIII displays the mean fraction of capability for personnel, materiel, and the unit.

TABLE XIII

UNIT CAPABILITY OVER TIME
(ALTERNATIVE CASE I)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.432	0.037	0.580	0.028	0.399	0.032
0.250	0.702	0.047	0.604	0.029	0.547	0.036
0.500	0.949	0.014	0.710	0.034	0.708	0.033
0.750	0.963	0.007	0.812	0.026	0.812	0.026
1.000	0.963	0.007	0.812	0.026	0.812	0.026
1.250	0.963	0.007	0.812	0.026	0.812	0.026
1.500	0.963	0.007	0.812	0.026	0.812	0.026
1.750	0.963	0.007	0.812	0.026	0.812	0.026
2.000	0.963	0.007	0.812	0.026	0.812	0.026
2.250	0.963	0.007	0.812	0.026	0.812	0.026
2.500	0.963	0.007	0.812	0.026	0.812	0.026
2.750	0.963	0.007	0.812	0.026	0.812	0.026
3.000	0.963	0.007	0.812	0.026	0.812	0.026
3.250	0.963	0.007	0.812	0.026	0.812	0.026
3.500	0.963	0.007	0.812	0.026	0.812	0.026
3.750	0.963	0.007	0.812	0.026	0.812	0.026
4.000	0.963	0.007	0.812	0.026	0.812	0.026
4.250	0.963	0.007	0.928	0.011	0.927	0.011
4.500	0.963	0.007	0.928	0.011	0.927	0.011
4.750	0.963	0.007	0.928	0.011	0.927	0.011
5.000	0.963	0.007	0.928	0.011	0.927	0.011
5.250	0.963	0.007	0.928	0.011	0.927	0.011
5.500	0.963	0.007	0.928	0.011	0.927	0.011
5.750	0.963	0.007	0.928	0.011	0.927	0.011
6.000	0.963	0.007	0.928	0.011	0.927	0.011
Infinity	0.963	0.007	0.928	0.011	0.927	0.011

A comparison with the base case is presented in Table XIV and shows that this set of PD values resulted in a slightly increased unit capability due to an improvement in materiel capability. It seems logical that they should have been identical since the probabilities of degradation for materiel do not change. The reason for the difference is due to the stochastic process and the "sort" routine used in the AMORE model. The first iteration change will throw all subsequent results out of sequence from the original run, thus yielding different results. The graphical comparison

of the resiliency curves of both cases over all time periods in Figure 4.1 suggests that the differences are insignificant.

TABLE XIV

COMPARISON OF MAXIMUM UNIT CAPABILITY FOR THE BASE CASE AND ALTERNATIVE CASE I

	Personnel	Materiel	Unit
Base Case	0.974	0.923	0.923
Alternative Case I	0.963	0.928	0.927

In this case, although the changing of the probability of degradation for personnel based on their degree of exposure to enemy direct fire weapons increased the capability of the light infantry company, the difference was not deemed significant enough to draw any viable conclusions.

2. Broad Variations of Personnel and Materiel PD Levels

The effect of widely varying levels of degradation probabilities for personnel along with a corresponding change to materiel probabilities of degradation was analyzed next. The degradation levels used include the base case as level 1 and are listed in Table XV. The results of running the AMORE model for each level are provided in Appendix B. Figure XVI presents the capability of the light infantry company at infinite time at each level.

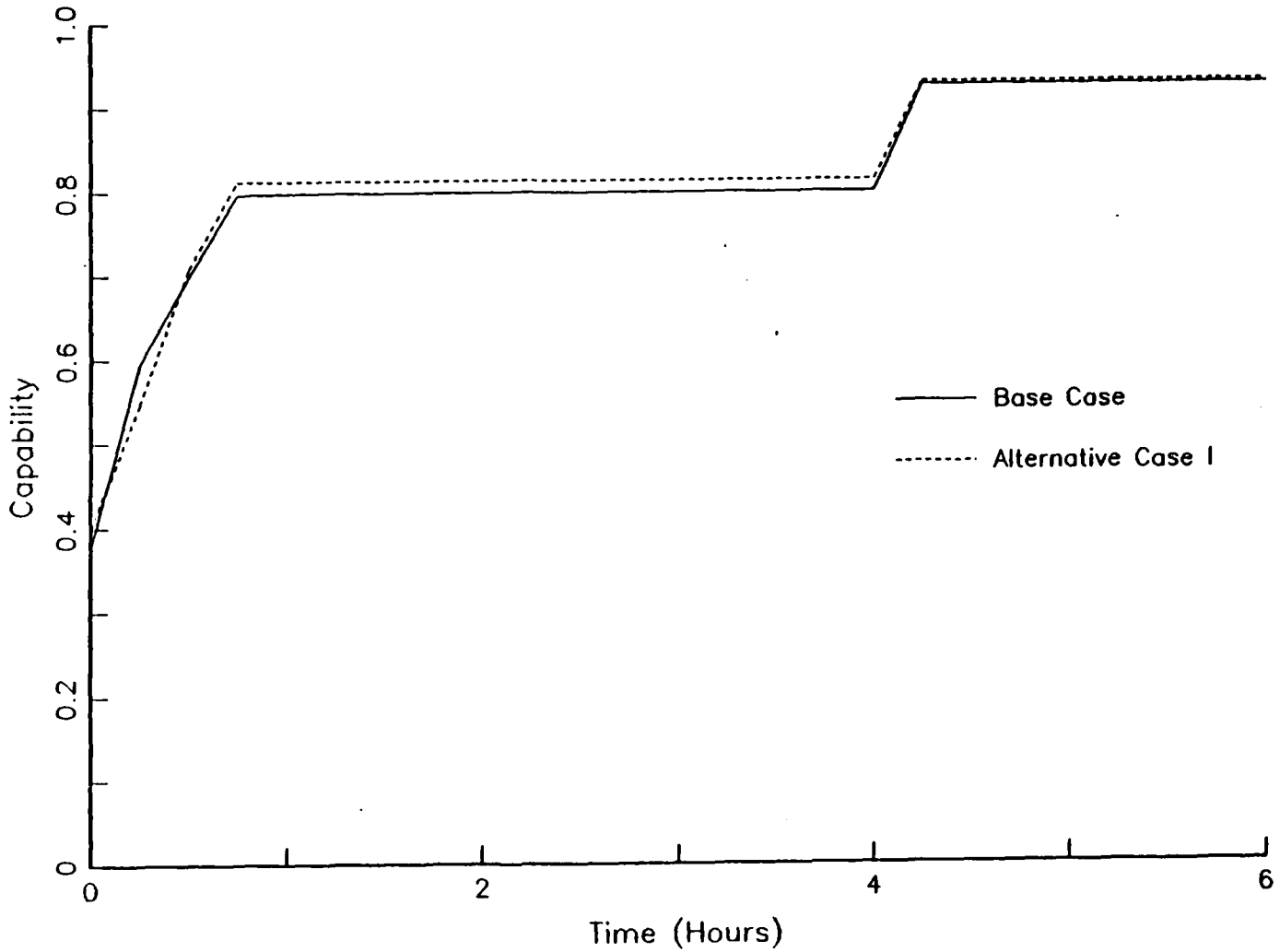


Figure 4.1 Comparison of Resiliency Curves for the Base Case and Alternative Case I.

TABLE XV

LEVELS OF PROBABILITY OF DEGRADATION

Level	Personnel PD	Materiel PD (Cumulative) At Least Light	At Least Moderate	Severe
1	.10	.10	.05	.02
2	.20	.20	.10	.04
3	.30	.30	.15	.06
4	.40	.40	.20	.08
5	.50	.50	.25	.10

TABLE XVI

MAXIMUM UNIT CAPABILITY

Level	Personnel	Materiel	Unit
1	0.974	0.923	0.923
2	0.858	0.882	0.839
3	0.749	0.819	0.732
4	0.649	0.781	0.640
5	0.518	0.771	0.518

The recovery capability of the light infantry company based on Table XVI is displayed in Figure 4.2. According to the resilience threshold (1-PD), it can be seen that the company is resilient between the 10 percent and 50

percent levels of degradation. Its capability to reconstitute after degradation is primarily limited by the number of survivors and not by the shortage of any particular skill or materiel items.

C. MISSION ESSENTIAL TEAMS

Although doctrine states that the rifle fire team is the smallest combat fighting force, its size (four members) under the light infantry concept may preclude it from undertaking very many missions. Therefore, in this section the squad will be considered as the basic increment of capability in determining mission essential teams. This results in nine mission essential teams for both personnel and materiel (Tables XVII and XVIII) versus eighteen for the rifle fire teams. The same total number of personnel and materiel was used in constructing these new mission essential teams.

The AMORE model was again run with all other input parameters kept constant. Table XIX displays the mean fraction of capability for personnel and materiel.

This trial resulted in a significant decrease in unit capability compared to the base case as shown in Table XX. Both personnel and materiel capabilities are lower at infinite time. Although personnel capability exceeds the criterion value of 1-PD as the resiliency threshold, the unit as well as the materiel does not, resulting in the company being not resilient. Figure 4.3 presents a graphical comparison of the resiliency curves of both cases over all time periods.

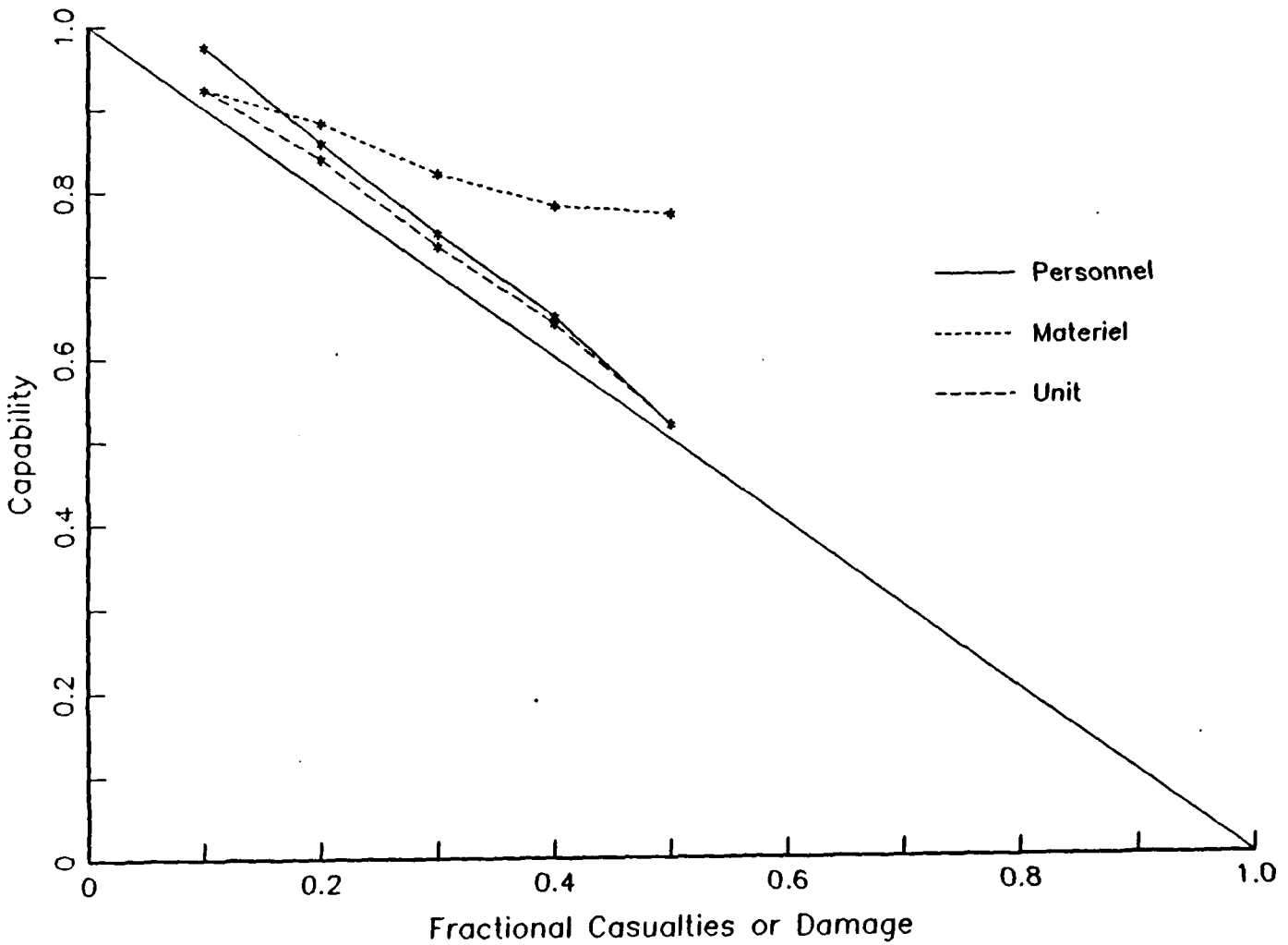


Figure 4.2 Recoverability from Combat Degradation.

TABLE XVII

MISSION ESSENTIAL TEAMS - PERSONNEL
(ALTERNATIVE CASE II)

	Personnel	MET 1	MET 2	MET 3	MET 4	MET 5	MET 6	MET 7	MET 8	MET 9
1	Company Commander	0	0	0	1	0	0	0	0	0
2	Executive Officer	0	0	0	0	0	0	0	0	0
3	First Sergeant	0	0	0	0	1	0	0	0	0
4	Supply Sergeant	0	0	0	0	0	0	0	0	1
5	Communications Chief	0	0	0	0	0	0	0	0	1
6	NBC NCO	0	0	0	0	0	0	0	0	1
7	Armorer	0	0	0	0	0	0	0	0	1
8	Company RATELO	0	0	0	1	0	0	0	0	0
9	Fire Support Team Chief	0	0	0	0	0	0	0	0	0
10	Fire Support Team Sergeant	0	0	0	0	0	0	0	0	0
11	Fire Support Team RATELO	0	0	0	0	0	0	0	0	0
12	Antiarmor Section Leader	0	0	0	0	1	0	0	0	0
13	Antiarmor Team leader	0	1	0	0	1	0	0	1	0
14	Antiarmor Gunner	0	1	1	0	1	1	0	1	1
15	Asst Antiarmor Gunner	0	0	1	0	0	1	0	0	1
16	Mortar Section Leader	0	0	0	0	0	0	1	0	0
17	Mortar Squad Leader	0	0	0	0	1	0	0	0	0
18	Mortar Gunner	0	0	0	0	1	0	1	0	0
19	Ammunition Bearer	0	0	0	0	1	0	1	0	0
20	Platoon Leader	0	1	0	1	0	0	1	0	0
21	Platoon Sergeant	0	0	1	0	1	0	0	1	0
22	Platoon RATELO	0	1	0	1	0	0	1	0	1
23	Machinegun Gunner	1	0	1	1	0	1	1	0	1
24	Asst Machinegun Gunner	1	0	1	1	0	1	1	0	1
25	Medic	0	0	0	0	0	0	0	0	1
26	Forward Observer	0	0	0	0	0	0	0	0	0
27	Forward Observer RATELO	0	0	0	0	0	0	0	0	1
28	Squad Leader	1	1	1	1	1	1	1	1	2
29	Team Leader	2	2	2	2	2	2	2	2	2
30	Automatic Rifleman	2	2	2	2	2	2	2	2	2
31	Grenadier	2	2	2	2	2	2	2	2	2
32	Rifleman	2	2	2	2	2	2	2	2	2

TABLE XVIII

MISSION ESSENTIAL TEAMS - MATERIEL
(ALTERNATIVE CASE II)

	Materiel	MET 1	MET 2	MET 3	MET 4	MET 5	MET 6	MET 7	MET 8	MET 9
1	Binocular	1	2	1	2	2	1	2	1	1
2	Chemical Alarm	0	0	0	0	0	0	0	0	1
3	Compass, Magnetic	0	0	0	0	1	0	1	0	0
4	Dragon	0	1	1	0	1	1	0	1	1
5	Grenade Launcher 40mm M-203	2	2	2	2	2	2	2	2	2
6	Infrared Viewer AN/PAS-7	0	0	0	1	1	0	1	0	0
7	Machinegun 7.62mm M-60	1	0	1	1	0	1	1	0	1
8	Mortar 60mm	0	0	0	0	1	0	1	0	0
9	Night Vision Goggles AN/PVS-5	4	4	4	4	4	4	4	4	4
10	Night Vision Sight AN/PVS-4	2	2	2	2	2	2	2	2	2
11	Night Vision Sight AN/TVS-5	1	0	1	1	0	1	1	0	1
12	Pistol Caliber .45	1	0	1	2	0	1	1	0	1
13	Platoon Early Warning System	0	1	0	1	0	0	1	0	0
14	Radiac Detector Charger	0	0	0	0	0	0	0	0	1
15	Radiac Set AN/PDR-27	0	0	0	0	0	0	0	0	0
16	Radiacmeter IM-174/PD	0	1	0	1	0	0	1	0	1
17	Radiacmeter IM-185/UD	1	2	1	2	1	1	2	1	1
18	Radio Set AN/PRC-77	0	1	0	2	1	0	2	0	0
19	Rifle 5.56mm M-16A2	6	9	9	9	13	8	11	8	10
20	Small Unit Transceiver	1	2	1	1	2	1	1	2	1
21	Speech Security Equipment	0	0	0	0	0	0	0	0	0
22	Squad Automatic Weapon	2	2	2	2	2	2	2	2	2
23	Tape Reader	0	0	0	0	0	0	0	0	0
24	Telephone Set TA-1/PT	1	2	1	2	2	1	3	1	1
25	Telephone Set TA-312/PT	0	0	0	0	0	0	0	0	1

TABLE XIX

UNIT CAPABILITY OVER TIME
(ALTERNATIVE CASE II)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.424	0.037	0.651	0.018	0.413	0.034
0.250	0.649	0.038	0.671	0.015	0.593	0.026
0.500	0.871	0.030	0.747	0.029	0.718	0.029
0.750	0.938	0.013	0.831	0.022	0.831	0.022
1.000	0.938	0.013	0.831	0.022	0.831	0.022
1.250	0.938	0.013	0.831	0.022	0.831	0.022
1.500	0.938	0.013	0.831	0.022	0.831	0.022
1.750	0.938	0.013	0.831	0.022	0.831	0.022
2.000	0.938	0.013	0.831	0.022	0.831	0.022
2.250	0.938	0.013	0.831	0.022	0.831	0.022
2.500	0.938	0.013	0.831	0.022	0.831	0.022
2.750	0.938	0.013	0.831	0.022	0.831	0.022
3.000	0.938	0.013	0.831	0.022	0.831	0.022
3.250	0.938	0.013	0.831	0.022	0.831	0.022
3.500	0.938	0.013	0.831	0.022	0.831	0.022
3.750	0.938	0.013	0.831	0.022	0.831	0.022
4.000	0.938	0.013	0.831	0.022	0.831	0.022
4.250	0.938	0.013	0.880	0.014	0.876	0.013
4.500	0.938	0.013	0.880	0.014	0.876	0.013
4.750	0.938	0.013	0.880	0.014	0.876	0.013
5.000	0.938	0.013	0.880	0.014	0.876	0.013
5.250	0.938	0.013	0.880	0.014	0.876	0.013
5.500	0.938	0.013	0.880	0.014	0.876	0.013
5.750	0.938	0.013	0.880	0.014	0.876	0.013
6.000	0.938	0.013	0.880	0.014	0.876	0.013
Infinity	0.938	0.013	0.880	0.014	0.876	0.013

D. CONCLUSIONS

The following summarizes the sensitivity of unit recovery rates to changes in the input parameters:

1. Small variations in personnel probability of degradation which modeled more realistic probabilities of exposure for various unit members resulted in insignificant differences in the capability levels.

TABLE XX

COMPARISON OF MAXIMUM UNIT CAPABILITY
FOR THE BASE CASE AND ALTERNATIVE CASE II

	Personnel	Materiel	Unit
Base Case	0.974	0.923	0.923
Alternative Case II	0.938	0.880	0.876

2. Broad variations of personnel and materiel probabilities of degradation levels identified the light infantry company as still being resilient to at least the 50 percent level of degradation.
3. Restructuring the number of mission essential teams from eighteen to nine revealed that the capability level decreased significantly to the point that the company was no longer resilient.

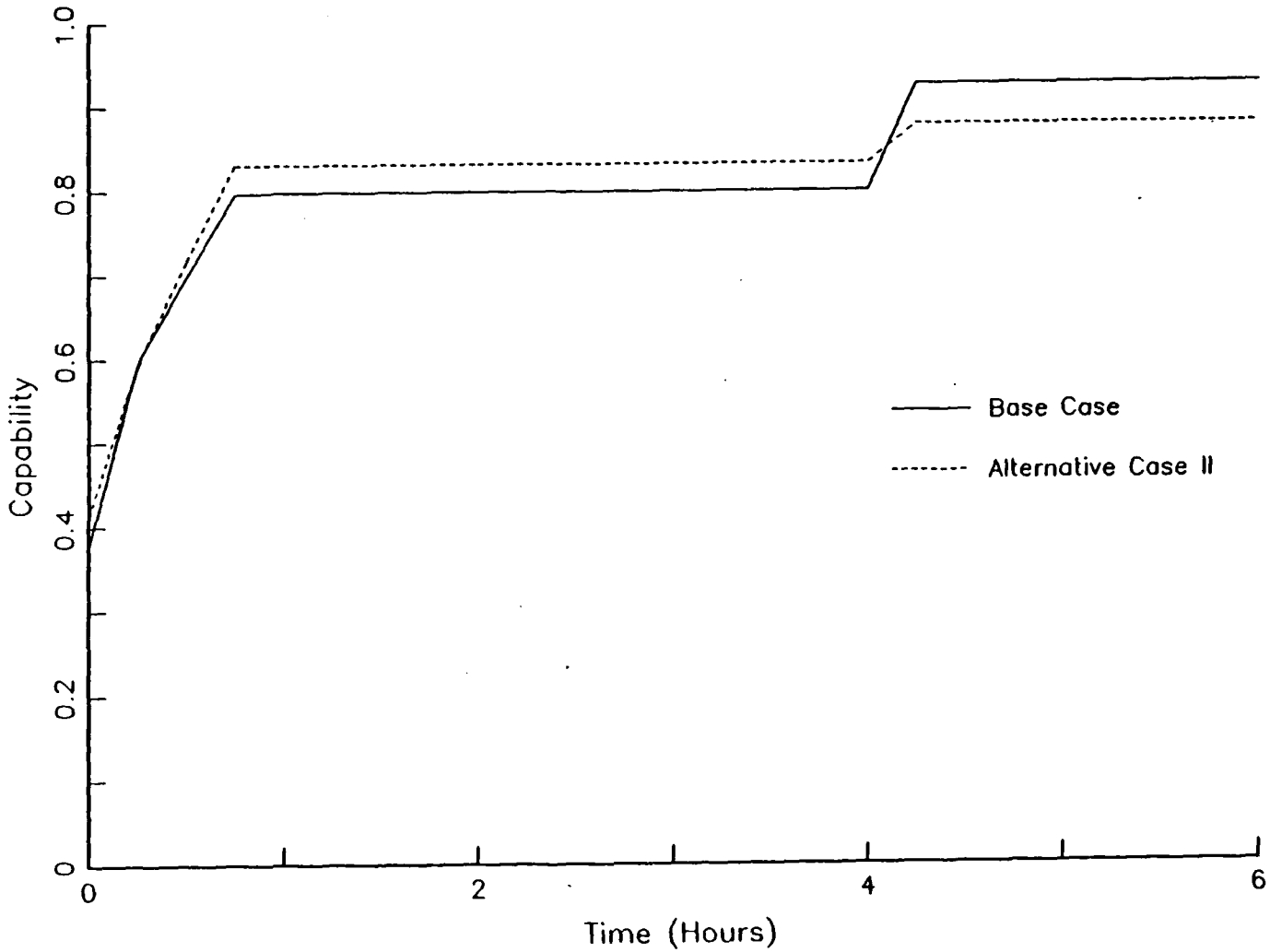


Figure 4.3 Comparison of Resiliency Curves for the Base Case and Alternative Case II.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The importance of the light infantry concept is to provide a capability of rapidly deploying a highly-trained unit in response to a contingency mission anywhere in the world. This light force would be particularly effective in meeting a crisis in a low-intensity scenario such as Grenada and Lebanon.

This thesis investigated the light infantry company for a night defensive mission in a nuclear, biological, and chemical (NBC) environment to identify, from a set of alternatives, the force structure that maximizes unit resiliency/recoverability on the battlefield. The Analysis of Military Organizational Effectiveness (AMORE) methodology, developed by Science Applications, Incorporated (SAI), was used to evaluate the alternatives.

Chapter I discussed the AMORE methodology, the light infantry concept, and the purpose of this thesis. Chapter II presented the extensive input data that was developed for the AMORE model. This data assumed the light infantry company was performing only the defense mission. The analyses of unit capability are presented in Chapter III. Some of the areas examined include capability as a function of time, potential productivity, and available surpluses and shortages. A sensitivity analysis was conducted in Chapter IV to investigate the effects of changes in degradation probabilities and the definition of a mission essential team on unit reconstitution capabilities.

B. CONCLUSIONS

Based on the results of this analysis, the following conclusions are provided:

1. The light infantry company, as currently designed for employment in low-intensity conflicts and as analyzed in this study, possesses resiliency/recoverability, as defined by SAI, if it is structured with eighteen mission essential teams. It is not resilient when only nine teams are constructed.
2. At a low level of degradation corresponding to the defense mission (probability of degradation = .10), the light infantry company is materiel-limited. However, at higher levels, personnel constraints become the limiting factors.
3. The choke analysis identified the squad leader and the team leader as the primary personnel shortfalls at a 10 percent probability of degradation.
4. Materiel recovery was affected by some low-density items such as the Dragon and the AN/PRC-77 radio set. Losses of these key items were found to be extremely degrading to the company's combat resiliency.
5. The relatively low rate of substitutability is attributable in part to the large number of technical jobs requiring specialized training.

C. RECOMMENDATIONS

The following recommendations are given:

1. Subsequent analyses of the light infantry company should establish the fire team as the increment of capability for determining mission essential teams.
2. Further specific areas of study that could complement this thesis include random exponential simulated times and increased probabilities of degradation.

3. The analyses of the capability of the light infantry company based on eighteen mission essential teams and on nine teams raised questions about the definition of resiliency and what an essential team is believed to do. This issue should be resolved.
4. At higher intensity conflicts, augmentation in personnel and materiel is likely to result in improved capability. AMORE analyses of the light infantry company for each type of attack and defense mission in every scenario of the strategic spectrum of conflict is needed to provide a complete picture of the resiliency of the company.
5. The procedures for determining the probability of degradation for infantry equipment should be investigated since many of the choke points uncovered by AMORE may be due to an artificially high degradation level for materiel.
6. Increasing the quantities of the critical low-density items may be appropriate and should be evaluated.
7. In the sensitivity analysis, an attempt was made to have various personnel elements of the company have different risks of being degraded. This concept suggests that some type of weighting factors, based upon external analysis such as combat simulations or Joint Munitions Effectiveness Manual (JMEM) methodologies, could be developed and assigned to each element to reflect the varying risks.
8. The value of substitutability is so significant that every effort should be made by Table of Organization and Equipment (TOE) builders to insure that all possible substitutions are recognized and considered in structuring the organization of a unit.
9. Cross-training and on-the-job training should be increased to improve the light infantry company's

reconstitution ability as a result of greater substitutability. Lower skill level personnel should be trained to work and plan as effectively as possible with minimum supervision. Emphasis should be placed at unit level to train for reconstitution.

10. The application of high technology to reduce materiel losses or repair times can reap great benefits. Due to the limited mobility of the light infantry, continued emphasis must be placed on equipment design oriented toward reduced size and weight. Some design criteria would be high reliability and maintainability, man-portability, survivability, and longer range. This would significantly increase the ability of the light infantry company to reconstitute.
11. Although the AMORE methodology has value in providing insights into existing organizations and into individual training objectives, it should be used in conjunction with, not to replace, the present US Army Training and Doctrine Command (TRADOC) TOE development methodology.

APPENDIX A

CHOKE ANALYSIS NEEDS AND SURPLUS

TABLE XXI

CHOKE ANALYSIS DATA - PERSONNEL (TEAM 18)

	Needs		Surplus	
Skill	Average	Std. Dev.	Average	Std. Dev.
1	0.00	0.00	0.00	0.00
2	0.00	0.00	0.04	0.21
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00
5	0.22	0.42	0.00	0.00
6	0.09	0.29	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.09	0.29
10	0.00	0.00	0.04	0.21
11	0.00	0.00	0.04	0.21
12	0.04	0.21	0.00	0.00
13	0.09	0.29	0.00	0.00
14	0.17	0.49	0.00	0.00
15	0.04	0.21	0.00	0.00
16	0.00	0.00	0.00	0.00
17	0.09	0.29	0.00	0.00
18	0.17	0.39	0.00	0.00
19	0.04	0.21	0.00	0.00
20	0.04	0.21	0.00	0.00
21	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00
25	0.00	0.00	2.70	0.56
26	0.00	0.00	0.00	0.00
27	0.00	0.00	0.04	0.21
28	0.39	0.58	0.00	0.00
29	1.04	1.19	0.00	0.00
30	0.13	0.46	0.00	0.00
31	0.13	0.34	0.00	0.00
32	0.00	0.00	0.00	0.00

Number of Iterations = 23.

TABLE XXII

CHOKE ANALYSIS DATA - PERSONNEL (AFTER LAST TEAM)

Skill	Surplus	
	Average	Std. Dev.
1	0.00	0.00
2	0.04	0.19
3	0.00	0.00
4	0.00	0.00
5	0.00	0.00
6	0.00	0.00
7	0.07	0.27
8	0.11	0.32
9	0.15	0.36
10	0.44	0.51
11	0.56	0.51
12	0.00	0.00
13	0.00	0.00
14	1.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	0.00	0.00
20	0.00	0.00
21	0.00	0.00
22	0.00	0.00
23	0.00	0.00
24	0.00	0.00
25	2.67	0.55
26	0.37	0.74
27	0.81	0.83
28	0.00	0.00
29	0.00	0.00
30	0.00	0.00
31	0.00	0.00
32	0.00	0.00

Number of Iterations = 27.

TABLE XXIII

CHOKE ANALYSIS DATA - MATERIEL (TEAM 15)

	Needs		Surplus	
Item	Average	Std. Dev.	Average	Std. Dev.
1	0.00	0.00	0.00	0.00
2	0.00	0.00	1.00	0.00
3	0.00	0.00	0.00	0.00
4	1.00	0.00	0.00	0.00
5	0.00	0.00	2.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
10	0.00	0.00	2.00	0.00
11	0.00	0.00	0.00	0.00
12	0.00	0.00	1.00	0.00
13	0.00	0.00	0.00	0.00
14	0.00	0.00	1.00	0.00
15	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00
17	0.00	0.00	2.00	0.00
18	0.00	0.00	0.00	0.00
19	0.00	0.00	5.00	0.00
20	0.00	0.00	2.00	0.00
21	0.00	0.00	4.00	0.00
22	0.00	0.00	1.00	0.00
23	0.00	0.00	1.00	0.00
24	0.00	0.00	2.00	0.00
25	0.00	0.00	1.00	0.00

Number of Iterations = 1.

TABLE XXIV

CHOKE ANALYSIS DATA - MATERIEL (TEAM 16)

	Needs		Surplus	
Item	Average	Std. Dev.	Average	Std. Dev.
1	0.00	0.00	0.20	0.45
2	0.00	0.00	1.00	0.00
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.60	0.55
5	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.20	0.45
10	0.00	0.00	0.80	0.84
11	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00
14	0.00	0.00	1.00	0.00
15	0.00	0.00	0.40	0.55
16	0.00	0.00	0.00	0.00
17	0.00	0.00	0.40	0.55
18	0.80	0.45	0.00	0.00
19	0.00	0.00	0.60	1.34
20	0.20	0.45	0.00	0.00
21	0.00	0.00	3.00	1.00
22	0.00	0.00	0.20	0.45
23	0.00	0.00	1.00	0.00
24	0.00	0.00	0.20	0.45
25	0.00	0.00	0.80	0.45

Number of Iterations = 5.

TABLE XXV

CHOKE ANALYSIS DATA - MATERIEL (TEAM 17)

	Needs		Surplus	
Item	Average	Std. Dev.	Average	Std. Dev.
1	0.17	0.41	0.00	0.00
2	0.00	0.00	0.83	0.41
3	0.00	0.00	0.00	0.00
4	0.83	0.41	0.00	0.00
5	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00
14	0.00	0.00	0.67	0.52
15	0.00	0.00	0.17	0.41
16	0.00	0.00	0.00	0.00
17	0.00	0.00	0.33	0.52
18	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00
20	0.00	0.00	2.50	0.55
21	0.00	0.00	3.50	0.55
22	0.00	0.00	0.00	0.00
23	0.00	0.00	1.00	0.00
24	0.00	0.00	0.33	0.52
25	0.00	0.00	0.67	0.52

Number of Iterations = 6.

TABLE XXVI

CHOKE ANALYSIS DATA - MATERIEL (TEAM 18)

Item	Needs		Surplus	
	Average	Std. Dev.	Average	Std. Dev.
1	0.26	0.55	0.00	0.00
2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00
5	0.29	0.46	0.00	0.00
6	0.11	0.31	0.00	0.00
7	0.05	0.23	0.00	0.00
8	0.08	0.27	0.00	0.00
9	0.47	0.65	0.00	0.00
10	0.45	0.65	0.00	0.00
11	0.00	0.00	0.00	0.00
12	0.11	0.39	0.00	0.00
13	0.08	0.27	0.00	0.00
14	0.03	0.16	0.00	0.00
15	0.00	0.00	0.00	0.00
16	0.05	0.23	0.00	0.00
17	0.16	0.37	0.00	0.00
18	0.13	0.34	0.00	0.00
19	1.89	1.35	0.00	0.00
20	0.16	0.37	0.00	0.00
21	0.00	0.00	3.55	0.69
22	0.37	0.71	0.00	0.00
23	0.00	0.00	0.92	0.27
24	0.24	0.49	0.00	0.00
25	0.03	0.16	0.00	0.00

Number of Iterations = 38.

APPENDIX B

MEAN CAPABILITY FOR VARIOUS LEVELS OF PROBABILITY OF DEGRADATION

TABLE XXVII

UNIT CAPABILITY OVER TIME
(LEVEL 1)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.394	0.033	0.589	0.034	0.376	0.027
0.250	0.747	0.043	0.618	0.032	0.596	0.035
0.500	0.962	0.011	0.699	0.035	0.699	0.035
0.750	0.974	0.007	0.797	0.025	0.797	0.025
1.000	0.974	0.007	0.798	0.025	0.798	0.025
1.250	0.974	0.007	0.798	0.025	0.798	0.025
1.500	0.974	0.007	0.798	0.025	0.798	0.025
1.750	0.974	0.007	0.798	0.025	0.798	0.025
2.000	0.974	0.007	0.798	0.025	0.798	0.025
2.250	0.974	0.007	0.798	0.025	0.798	0.025
2.500	0.974	0.007	0.798	0.025	0.798	0.025
2.750	0.974	0.007	0.798	0.025	0.798	0.025
3.000	0.974	0.007	0.798	0.025	0.798	0.025
3.250	0.974	0.007	0.798	0.025	0.798	0.025
3.500	0.974	0.007	0.798	0.025	0.798	0.025
3.750	0.974	0.007	0.798	0.025	0.798	0.025
4.000	0.974	0.007	0.798	0.025	0.798	0.025
4.250	0.974	0.007	0.923	0.010	0.923	0.010
4.500	0.974	0.007	0.923	0.010	0.923	0.010
4.750	0.974	0.007	0.923	0.010	0.923	0.010
5.000	0.974	0.007	0.923	0.010	0.923	0.010
5.250	0.974	0.007	0.923	0.010	0.923	0.010
5.500	0.974	0.007	0.923	0.010	0.923	0.010
5.750	0.974	0.007	0.923	0.010	0.923	0.010
6.000	0.974	0.007	0.923	0.010	0.923	0.010
Infinity	0.974	0.007	0.923	0.010	0.923	0.010

TABLE XXVIII

UNIT CAPABILITY OVER TIME
(LEVEL 2)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.330	0.028	0.482	0.029	0.316	0.023
0.250	0.564	0.047	0.522	0.028	0.458	0.034
0.500	0.837	0.020	0.658	0.024	0.648	0.025
0.750	0.858	0.009	0.717	0.022	0.714	0.021
1.000	0.858	0.009	0.717	0.022	0.714	0.021
1.250	0.858	0.009	0.717	0.022	0.714	0.021
1.500	0.858	0.009	0.717	0.022	0.714	0.021
1.750	0.858	0.009	0.717	0.022	0.714	0.021
2.000	0.858	0.009	0.717	0.022	0.714	0.021
2.250	0.858	0.009	0.717	0.022	0.714	0.021
2.500	0.858	0.009	0.717	0.022	0.714	0.021
2.750	0.858	0.009	0.717	0.022	0.714	0.021
3.000	0.858	0.009	0.717	0.022	0.714	0.021
3.250	0.858	0.009	0.717	0.022	0.714	0.021
3.500	0.858	0.009	0.717	0.022	0.714	0.021
3.750	0.858	0.009	0.717	0.022	0.714	0.021
4.000	0.858	0.009	0.717	0.022	0.714	0.021
4.250	0.858	0.009	0.882	0.017	0.839	0.014
4.500	0.858	0.009	0.882	0.017	0.839	0.014
4.750	0.858	0.009	0.882	0.017	0.839	0.014
5.000	0.858	0.009	0.882	0.017	0.839	0.014
5.250	0.858	0.009	0.882	0.017	0.839	0.014
5.500	0.858	0.009	0.882	0.017	0.839	0.014
5.750	0.858	0.009	0.882	0.017	0.839	0.014
6.000	0.858	0.009	0.882	0.017	0.839	0.014
Infinity	0.858	0.009	0.882	0.017	0.839	0.014

TABLE XXIX

UNIT CAPABILITY OVER TIME
(LEVEL 3)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.290	0.027	0.347	0.027	0.254	0.024
0.250	0.452	0.047	0.379	0.023	0.323	0.028
0.500	0.614	0.057	0.589	0.029	0.500	0.047
0.750	0.749	0.011	0.644	0.023	0.643	0.023
1.000	0.749	0.011	0.644	0.023	0.643	0.023
1.250	0.749	0.011	0.644	0.023	0.643	0.023
1.500	0.749	0.011	0.644	0.023	0.643	0.023
1.750	0.749	0.011	0.644	0.023	0.643	0.023
2.000	0.749	0.011	0.644	0.023	0.643	0.023
2.250	0.749	0.011	0.644	0.023	0.643	0.023
2.500	0.749	0.011	0.644	0.023	0.643	0.023
2.750	0.749	0.011	0.644	0.023	0.643	0.023
3.000	0.749	0.011	0.644	0.023	0.643	0.023
3.250	0.749	0.011	0.644	0.023	0.643	0.023
3.500	0.749	0.011	0.644	0.023	0.643	0.023
3.750	0.749	0.011	0.644	0.023	0.643	0.023
4.000	0.749	0.011	0.644	0.023	0.643	0.023
4.250	0.749	0.011	0.819	0.021	0.732	0.012
4.500	0.749	0.011	0.819	0.021	0.732	0.012
4.750	0.749	0.011	0.819	0.021	0.732	0.012
5.000	0.749	0.011	0.819	0.021	0.732	0.012
5.250	0.749	0.011	0.819	0.021	0.732	0.012
5.500	0.749	0.011	0.819	0.021	0.732	0.012
5.750	0.749	0.011	0.819	0.021	0.732	0.012
6.000	0.749	0.011	0.819	0.021	0.732	0.012
Infinity	0.749	0.011	0.819	0.021	0.732	0.012

TABLE XXX

UNIT CAPABILITY OVER TIME
(LEVEL 4)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.239	0.024	0.261	0.028	0.206	0.024
0.250	0.394	0.035	0.287	0.025	0.256	0.024
0.500	0.568	0.043	0.512	0.036	0.454	0.043
0.750	0.649	0.011	0.591	0.026	0.576	0.024
1.000	0.649	0.011	0.591	0.026	0.576	0.024
1.250	0.649	0.011	0.591	0.026	0.576	0.024
1.500	0.649	0.011	0.591	0.026	0.576	0.024
1.750	0.649	0.011	0.591	0.026	0.576	0.024
2.000	0.649	0.011	0.591	0.026	0.576	0.024
2.250	0.649	0.011	0.591	0.026	0.576	0.024
2.500	0.649	0.011	0.591	0.026	0.576	0.024
2.750	0.649	0.011	0.591	0.026	0.576	0.024
3.000	0.649	0.011	0.591	0.026	0.576	0.024
3.250	0.649	0.011	0.591	0.026	0.576	0.024
3.500	0.649	0.011	0.591	0.026	0.576	0.024
3.750	0.649	0.011	0.591	0.026	0.576	0.024
4.000	0.649	0.011	0.591	0.026	0.576	0.024
4.250	0.649	0.011	0.781	0.025	0.640	0.015
4.500	0.649	0.011	0.781	0.025	0.640	0.015
4.750	0.649	0.011	0.781	0.025	0.640	0.015
5.000	0.649	0.011	0.781	0.025	0.640	0.015
5.250	0.649	0.011	0.781	0.025	0.640	0.015
5.500	0.649	0.011	0.781	0.025	0.640	0.015
5.750	0.649	0.011	0.781	0.025	0.640	0.015
6.000	0.649	0.011	0.781	0.025	0.640	0.015
Infinity	0.649	0.011	0.781	0.025	0.640	0.015

TABLE XXXI

UNIT CAPABILITY OVER TIME
(LEVEL 5)

Time (Hours)	Personnel		Materiel		Unit	
Minimum	0.197	0.023	0.197	0.025	0.144	0.019
0.250	0.320	0.032	0.229	0.023	0.199	0.021
0.500	0.446	0.036	0.430	0.033	0.358	0.035
0.750	0.518	0.021	0.521	0.025	0.471	0.022
1.000	0.518	0.021	0.522	0.025	0.471	0.022
1.250	0.518	0.021	0.522	0.025	0.471	0.022
1.500	0.518	0.021	0.522	0.025	0.471	0.022
1.750	0.518	0.021	0.522	0.025	0.471	0.022
2.000	0.518	0.021	0.522	0.025	0.471	0.022
2.250	0.518	0.021	0.522	0.025	0.471	0.022
2.500	0.518	0.021	0.522	0.025	0.471	0.022
2.750	0.518	0.021	0.522	0.025	0.471	0.022
3.000	0.518	0.021	0.522	0.025	0.471	0.022
3.250	0.518	0.021	0.522	0.025	0.471	0.022
3.500	0.518	0.021	0.522	0.025	0.471	0.022
3.750	0.518	0.021	0.522	0.025	0.471	0.022
4.000	0.518	0.021	0.522	0.025	0.471	0.022
4.250	0.518	0.021	0.770	0.019	0.518	0.021
4.500	0.518	0.021	0.770	0.019	0.518	0.021
4.750	0.518	0.021	0.771	0.019	0.518	0.021
5.000	0.518	0.021	0.771	0.019	0.518	0.021
5.250	0.518	0.021	0.771	0.019	0.518	0.021
5.500	0.518	0.021	0.771	0.019	0.518	0.021
5.750	0.518	0.021	0.771	0.019	0.518	0.021
6.000	0.518	0.021	0.771	0.019	0.518	0.021
Infinity	0.518	0.021	0.771	0.019	0.518	0.021

LIST OF REFERENCES

1. Science Applications, Incorporated, Organizational Development for a Small Unit Design Analysis, Report dated August 1979.

2. United States Army Infantry School, Field Circular 7-14: Light Infantry Company Operations and ARTEP Mission Training Plan (AMTP), Report dated February 19, 1985.

3. Dupuy, William E. (Gen. USA, Ret.), "The Light Infantry: Indispensable Element of a Balanced Force", Army, pp. 26-41, June 1985.

4. Combined Arms Combat Development Activity, Operational Concept for the Infantry Division (Light), Report dated March 15, 1984.

5. Wickham, John A. (Gen., Chief of Staff, US Army), "White Paper", April 16, 1984.

6. United States Army Armor Center, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Mechanized Infantry Company, Report dated December 10, 1982.

7. United States Army Ordnance Center and School, AMORE Analysis of Light Infantry Division Maintenance Battalion, Report dated January 31, 1984.

8. Science Applications, Incorporated, Analysis of Military Organizational Effectiveness (AMORE) Implementation Handbook (A Supplement to the User's Handbook), Report dated May 1982.

9. Science Applications, Incorporated, Analysis of Military Organizational Effectiveness (AMORE) User's Handbook, Report dated December 1982.

10. Science Applications, Incorporated, Analysis of Military Organizational Effectiveness (AMORE) Programmer's Manual, Report dated April 1981.

BIBLIOGRAPHY

Hassell, Timothy B., Army of Excellence Final Report, Volume II, The Light Infantry Division, June 29, 1984.

Negrelli, Edward P., An Analysis of the AMORE Methodology, MS Thesis, Naval Postgraduate School, CA., December 1984.

Science Applications, Incorporated, An Analysis of the Capability of Alternative Division-86 155mm Howitzer Battery Organizations, Report dated July 1982.

Science Applications, Incorporated, Analysis of Military Organizational Effectiveness (AMORE) - Commander's Kit Final Report, Report dated January 1982.

Science Applications, Incorporated, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Light Infantry Division, Report dated March 30, 1984.

Science Applications, Incorporated, Analysis of Military Organizational Effectiveness (AMORE) Apple II Computer Version User's Handbook, Report dated October 1983.

Science Applications, Incorporated, Design of a Battalion Combined Arms Task Force, Report dated April 1983.

United States Army Armor Center, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Tank Company, Report dated October 5, 1984.

United States Army Aviation School, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Light Infantry Division Transportation Aviation Maintenance Company, Report dated January 16, 1984.

United States Army Combat Developments Experimentation Center, Light Division Certification, Phase I, Infantry, Artillery, and Engineer ARTEPs - Certification Design Plan (Draft), January 28,1985.

United States Army Combined Arms Center, Independent Evaluation Plan (IEP) for Certification of the Light Infantry Division, February 27,1985.

United States Army Engineer School, Analysis of Military Organizational Effectiveness (AMORE) Report on the Engineer Battalion, Infantry Division (Light), Report dated March 1, 1984.

United States Army Infantry School, Field Circular 7-13 : Light Infantry Battalion and Brigade Operations and Battalion ARTEP Mission Training Plan (AMTP), May 1985.

United States Army Infantry School, Field Circular 7-15 : Light Infantry Squad and Platoon Operations and ARTEP Mission Training Plan (AMTP), December 1984.

United States Army Infantry School, Field Manual 7-10 : The Infantry Rifle Company (Infantry, Airborne, Air Assault, Ranger), January 8, 1982.

United States Army Infantry School, Field Manual 7-20 : The Infantry Battalion (Infantry, Airborne, and Air Assault), December 1984.

United States Army Infantry School, Special Text 7-153 : Tactical Operations Handbook, Fiscal Year 1974.

United States Army Infantry School, Special Text 7-190 : Army Training and Evaluation Program - Soldier's Manual Extract, January 1978.

United States Army Logistics Center, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Light Infantry Division DISCOM Headquarters and Headquarters Company, Report dated January 16, 1984.

United States Army Logistics Center, Revised AMORE Analysis of the Light Infantry Division Support Command, Report dated May 21, 1984.

United States Army Ordnance Center, Analysis of Military Organizational Effectiveness (AMORE) Study of the Light Infantry Division Maintenance Battalion : Sensitivity of Unit Resiliency to Variations in Combat Damage Probability, Report dated May 17, 1984.

United States Army Quartermaster School, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Infantry Division - 84 DISCOM, Report dated January 27, 1984.

United States Army Signal School, Interim Report AMORE/AURA Pilot Project, Report dated July 24, 1984.

United States Army Transportation School, Analysis of Military Organizational Effectiveness (AMORE) Analysis of the Light Infantry Division Transportation Motor Transport Company of the Supply and Transport Battalion, Report dated February 15, 1984.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93943-5100	2
3.	Professor Alan W. McMasters, Code 55Mg Department of Operations Research Naval Postgraduate School Monterey, California 93943-5100	3
4.	TRADOC Research Element Monterey (TREM) Naval Postgraduate School Monterey, California 93943-5100	4
5.	Major Hirome Fujio 376-A Bergin Drive Monterey, California 93940	2

END

FILMED

12-85

DTIC